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TRANSACTIONS

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

FOR THE YEAR 1900.

VOLUME XVI.

PHILADELPHIA:
PRINTED FOR THE ASSOCIATION.
1900.

Copies may be had of the Secretary.

VOL. XI. contains a complete Index of 11 volumes.

DORNAN, PRINTER.

OFFICERS OF THE ASSOCIATION, 1900.

President.

ABRAHAM JACOBI, M.D., New York.

Vice-Presidents.

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Representative to the Executive Committee of the Congress of American Physicians and Surgeons for 1900.

FREDERICK I. KNIGHT, M.D., Boston.
ROLAND G. CURTIN, M.D., Philadelphia, *Alternate.*

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[1] This paper was not forwarded to the Secretary for publication.

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Presidents.

Name.	Year.
A. L Loomis	1884–5.
William Pepper	1886.
Frank Donaldson	1887.
A. L. Loomis	1888.
V. Y. Bowditch	1889.
Charles Denison	1890.
F. I. Knight	1891.
W. E. Ford	1892.
R. G. Curtin	1893.
A. H. Smith	1894.
S. E. Solly	1895.
J. B. Walker	1896.
E. Fletcher Ingals	1897.
E. O. Otis	1898.
Beverley Robinson	1899.
Abraham Jacobi	1900.
Robert H. Babcock	1901.

Vice-Presidents.

F. I. Knight, W. H. Geddings	1884–5.
Frank Donaldson, Beverley Robinson	1886.
V. Y. Bowditch, R. G. Curtin	1887.
A. Y. P. Garnett, J. T. Whittaker	1888.
J. R. Leaming, E. T. Bruen	1889.
A. L. Gihon, H. B. Baker	1890.
E. L. Trudeau, T. S. Hopkins	1891.
E. Fletcher Ingals, Beverley Robinson	1892.
A. H. Smith, E. O. Otis	1893.
I. Hull Platt, E. L. Trudeau	1894.
John H. Musser, G. R. Butler	1895.
Charles E. Quimby, James A. Hart	1896.
S. A. Fisk, John C. Munro	1897.
Beverley Robinson, C. F. McGahan	1898.
James A. Hart, R. C. Newton	1899.
R. H. Babcock, John Winters Brannan	1900.
Albert C. Peale, S. W. Landmaid	1901.

Secretaries and Treasurers.

James B. Walker	1884–95.
Guy Hinsdale	1895–1901.

ALFRED STILLÉ, M.D., LL.D.

Died September 24, 1900.

HONORARY MEMBER.

LIST OF MEMBERS.

Honorary Members.

ELECTED

1897. Weber, Sir Hermann, 10 Grosvenor Street, W., London, England.

1897. Williams, Charles Theodore, 2 Upper Brook Street, W., London.

Corresponding Members.

1898. Eyre, G. G., Claremont, Cape Town, South Africa.

1898. Gache, Samuel, 729 Corrientes Street, Buenos Ayres, South America.

1898. Licéaga, Eduardo, 4 San Andres Street, Mexico.

1898. Orvananos, Domingo, 25 Chavarria Street, Mexico.

1898. Ruedi, Carl, Arosa, Switzerland.

1898. Sunderland, Septimus, 11 Cavendish Place, Cavendish Square, W., London.

1898. Wragge, Clement L., Brisbane, Queensland, Australia.

Active Members.

1888. Abbot, Griffith E., 13½ Street and Pennsylvania Avenue, Washington, D. C.

1897. Alden, C. H., Assistant Surgeon-General, U. S. A. (Retd.), Washington, D. C.

1897. Alton, Charles D., 86 Farmington Avenue, Hartford, Conn.

1898. Anders, Howard S., 1836 Wallace Street, Philadelphia.

1889. Anders, J. M., 1605 Walnut Street, Philadelphia.

1890. Anderson, B. P., Colorado Springs, Col.

1900. Arnold, Horace D., 188 Warren Street, Boston.

ELECTED

1893. Babcock, R. H., 103 State Street, Chicago.
1885. Baker, Henry B., 726 Ottawa Street, Lansing, Mich.
1898. Baldwin, Edward R., Saranac Lake, N. Y.
1898. Battle, S. Westray, Asheville, N. C.
1885. Bell, A. N., 337 Clinton Street, Brooklyn.
1896. Bergey, David H., Laboratory of Hygiene, University of Pennsylvania, Philadelphia.
1896. Bernardy, E. P., 221 South 17th Street, Philadelphia.
1897. Billings, Frank, 35 22d Street, Chicago.
1897. Blackader, Alexander D., 236 Mountain Street, Montreal, Canada.
1895. Boardman, W. S., 57 Hancock Street, Boston.
1897. Bonney, S. G., 726 14th Street, Denver.
1884. Bosworth, F. H., 41 Park Avenue, N. Y.
1885. Bowditch, V. Y., 506 Beacon Street, Boston.
1895. Brandt, C. N., Hot Springs, Va.
1891. Brannan, John W., 11 West 12th Street, N. Y.
1894. Bridge, Norman, 217 South Broadway, Los Angeles, California.
1898. Brower, D. R., 597 Jackson Boulevard, Chicago.
1897. Brown, Sanger, Reliance Building, Chicago.
1890. Buckley, J. J., Missoula, Mont.
1896. Bulette, W. W., Central Block, Pueblo, Col.
1898. Bulkley, L. D., 4 East 37th Street, New York.
1886. Butler, G. R., 229 Gates Avenue, Brooklyn.

1896. Campbell, W. A., 38 Bank Building, Colorado Springs.
1898. Casselberry, W. E., 34 Washington Street, Chicago.
1894. Chapin, Frederick W., Hot Springs, Va.
1887. Chapman, S. H., New Haven, Conn.
1898. Chappell, Walter F., 7 East 55th Street, New York.
1898. Cleemann, Richard A., 2135 Spruce Street, Philadelphia.
1894. Coleman, Thomas D., 563 Green Street, Augusta, Ga.
1889. Coolidge, A., Jr., 613 Beacon Street, Boston.
1885. Curtin, R. G., 22 South 18th Street, Philadelphia.

1892. Daland, Judson, 317 South 18th Street, Philadelphia.
1885. Daly, W. H., 6211 Howe Street, East End, Pittsburg, Pa.

ELECTED

1890. Darlington, Thomas, Jr., King's Bridge, New York City.
1897. Davis, N. S., Jr., 65 Randolph Street, Chicago.
1884. Denison, Charles, 823 14th Street, Denver.
1897. De Witt, Calvin, Surgeon U. S. A., Havana.
1884. Didama, H. D., 424 South Salina Street, Syracuse, N. Y.
1890. Dodge, H. O., Boulder, Colorado.
1898. Dudley, E. C., 1617 Indiana Avenue, Chicago.
1896. Dudley, Wm. F., 32 Livingston Street, Brooklyn.

1897. Edson, Carroll E., McPhee Building, Denver, Col.
1892. Elsner, H. L., Fayette Park, Syracuse, N. Y.
1885. Eskridge, J. T., 204 Equitable Building, Denver, Col.

1887. Fisk, Samuel A., 37 18th Street, Denver, Col.
1885. Ford, Willis E., 266 Genesee Street, Utica, N. Y.
1897. Futterer, Gustav, 34 Washington Street, Chicago.

1896. Gardiner, C. F., 224 Pike's Peak Avenue, Colorado Springs, Col.
1886. Garnett, A. S., Hot Springs, Ark.
1898. Getchell, Albert C., 6 Linden Street, Worcester, Mass.
1892. Gibson, William M., 260 Genesee Street, Utica, N. Y.
1884. Glasgow, W. C., 2847 Washington Avenue, St. Louis.

1893. Hance, I. H., Lakewood, N. J.
1896. Hare, Hobart A., 222 South 15th Street, Philadelphia.
1891. Hart, James A., Colorado Springs, Col.
1900. Harvey, Thomas W., 463 Main Street, Orange, N. J.
1896. Heffron, John L., 528 South Salina Street, Syracuse, N. Y.
1893. Hinsdale, Guy, 3943 Chestnut Street, Philadelphia.
1885. Hopkins, Thomas S., Thomasville, Ga.

1884. Ingals, E. Fletcher, 34 Washington Street, Chicago.

1900. Jackson, Henry, 309 Marlborough Street, Boston.
1889. Jacobi, A., 110 West 34th Street, New York.
1888. Jayne, W. A., 217 McPhee Building, Denver, Col.

ELECTED

1897. Johnson, Frank S., 2521 Prairie Avenue, Chicago.
1886. Johnston, W. W., 1603 K Street, N. W., Washington, D. C.
1893. Judd, L. D , 3603 Powelton Avenue, Philadelphia.

1890. Kellogg, J. H., Battle Creek, Mich.
1899. Klebs, Arnold C., 600 State Street, Chicago.
1884. Knight, Frederick I., 195 Beacon Street, Boston.

1887. Langmaid, S. W., 373 Boylston Street, Boston.
1899. Le Fevre, Egbert, 52 West 56th Street, N. Y.
1896. Loomis, Henry P., 58 East 34th Street, New York.

1887. Mays, Thomas J., 1829 Spruce Street, Philadelphia.
1894. McGahan, C. F., Aiken, S. C., and Bethlehem, N. H.
1899. Minor, Charles L., Asheville, N. C.
1889. Munro, John C., 173 Beacon Street, Boston.
1886. Musser, John H., 1927 Chestnut Street, Philadelphia.

1900. Nammack, Charles E., 42 East 29th Street, New York.
1895. Newton, R. C., 42 Church Street, Montclair, N. J.
1899. Norrie, V. H., 21 West 37th Street, New York.
1888. Nunn, Richard J., 119 York Street, Savannah.

1884. Orme, H. S., 175 North Spring Street, Los Angeles, Cal.
1888. Otis, E. O., 308 Commonwealth Avenue, Boston.

1887. Peale, A. C., 605 12th Street, N. W., Washington, D. C.
1900. Pearce, F. Savary, 1407 Locust Street, Philadelphia.
1893. Peterson, Frederick, 60 West 50th Street, New York.
1895. Phillips, W. F. R., Weather Bureau, Washington, D. C.
1885. Platt, Isaac Hull, 30 West 71st Street, New York.
1887. Platt, Walter B., 802 Cathedral Street, Baltimore.

1891. Quimby, Charles E., 44 West 36th Street, New York.

1891. Ransom, C. C., 152 West 48th Street, New York (Richfield Springs).
1884. Reed, Boardman, 1831 Chestnut Street, Philadelphia.
1885. Rice, C. C., 123 East 19th Street, New York.

ELECTED

1893. Risley, S. D., 1824 Chestnut Street, Philadelphia.
1899. Rives, William C., 1723 I Street, Washington, D. C.
1884. Robinson, Beverley, 42 West 37th Street, New York.
1890. Robinson, W. D., 2012 Mt. Vernon Street, Philadelphia.
1892. Roe, John O., 28 North Clinton Street, Rochester, N. Y.
1890. Rogers, E. J. A., 222 Colfax Avenue, Denver, Col.
1889. Ruck, Carl von, Asheville, N. C.

1884. Schauffler, E. W., 1221 Washington Street, Kansas City, Mo.
1884. Shurly, E. L., 32 Adams Avenue, West Detroit, Mich.
1890. Smith, A. Alexander, 8 West 47th Street, New York.
1885. Smith, Andrew H., 18 East 47th Street, New York.
1887. Smith, Frank Fremont, Palm Beach, Florida, and Bar Harbor, Maine.
1887. Solly, S. E., 2 North Cascade Avenue, Colorado Springs, Colorado.
1900. Stengel, Alfred, 1811 Spruce Street, Philadelphia.
1898. Stubbert, J. Edward, Liberty, New York.

1892. Taylor, H. Longstreet, 75 Lowry Arcade, St. Paul, Minn.
1896. Taylor, J. Madison, 1504 Pine Street, Philadelphia.
1885. Trudeau, E. L., Saranac Lake, N. Y.
1884. Tyndale, J. Hilgard, 13th and P. Streets, Lincoln, Neb.

1884. Walker, James B., 1617 Green Street, Philadelphia.
1891. Watson, E. W., 131 North 20th Street, Philadelphia.
1895. Weber, Leonard, 25 West 46th Street, New York.
1897. Whitcomb, H. H., Norristown, Pa.
1898. Whitney, Herbert B., 726 14th Street, Denver, Col.
1898. Williams, Francis H., 505 Beacon Street, Boston.
1898. Williams, Harold, 528 Beacon Street, Boston.
1885. Williams, H. F., 197 Gates Avenue, Brooklyn.
1884. Wilson, James C., 1437 Walnut Street, Philadelphia.

Total, 128 active members.

MINUTES.

The Seventeenth Annual Meeting of the American Climatological Association was called to order at the Arlington Hotel, Washington, D. C., on May 1, 1900, in connection with the Fifth Congress of American Physicians and Surgeons. The President, Dr. Abraham Jacobi, of New York, occupied the chair.

The following members were in attendance during the sessions:

Dr. Griffith E. Abbot, Washington, D. C.
Col. C. H. Alden, Assistant Surgeon-General, U. S. A.
Dr. J. M. Anders, Philadelphia.
Dr. R. H. Babcock, Chicago.
Dr. Edward R. Baldwin, Saranac Lake, N. Y.
Dr. A. N. Bell, Brooklyn.
Dr. E. P. Bernardy, Philadelphia.
Dr. Alexander Blackader, Montreal.
Dr. S. G. Bonney, Denver.
Dr. John W. Brannan, New York.
Dr. Norman Bridge, Los Angeles, Cal.
Dr. W. A. Campbell, Colorado Springs.
Dr. W. E. Casselberry, Chicago.
Dr. Frederick W. Chapin, Hot Springs, Va.
Dr. Walter F. Chappell, New York.
Dr. Richard A. Cleemann, Philadelphia.
Dr. Thomas D. Coleman, Augusta, Ga.
Dr. R. G. Curtin, Philadelphia.
Dr. Judson Daland, Philadelphia.
Dr. W. H. Daly, Pittsburg.
Dr. Thomas Darlington, Jr., New York.
Dr. N. S. Davis, Jr., Chicago.
Dr. Charles Denison, Denver.
Dr. Carroll E. Edson, Denver.
Dr. H. L. Elsner, Syracuse.
Dr. Samuel A. Fisk, Denver.
Dr. James A. Hart, Colorado Springs.
Dr. Guy Hinsdale, Philadelphia.
Dr. A. Jacobi, New York.
Dr. Frank S. Johnson, Chicago.

Dr. W. W. Johnston, Washington, D. C.
Dr. J. H. Kellogg, Michigan.
Dr. Arnold C. Klebs, Chicago.
Dr. S W. Langmaid, Boston.
Dr. Henry P. Loomis, New York.
Dr. C. F. McGahan, Aiken, S. C.
Dr. Charles L Minor, Asheville.
Dr. John H. Musser, Philadelphia.
Dr. R. C. Newton, Montclair, N. J.
Dr. V. H. Norrie, New York.
Dr. E. O. Otis, Boston.
Dr. A. C. Peale, Washington, D. C.
Dr. W. F. R. Phillips, Washington, D. C.
Dr. Charles E. Quimby, New York.
Dr. Boardman Reed, Philadelphia.
Dr. S. D. Risley, Philadelphia.
Dr. William C. Rives, Washington, D. C.
Dr. Beverley Robinson, New York.
Dr. W. D. Robinson, Philadelphia.
Dr. John O. Roe, Rochester, N. Y.
Dr. Carl von Ruck, Asheville.
Dr. A. Alexander Smith, New York.
Dr. S. E. Solly, Colorado Springs.
Dr. J. Edward Stubbert, Liberty, N. Y.
Dr. H. Longstreet Taylor, St. Paul.
Dr. J. Madison Taylor, Philadelphia.
Dr. James B. Walker, Philadelphia.
Dr. Leonard Weber, New York.
Dr. Francis H. Williams, Boston.
Dr. Harold Williams, Boston.
Dr. James C. Wilson, Philadelphia.

The Secretary, Dr. Guy Hinsdale, made the following report:

The Association enters upon its seventeenth year with a membership of 127. We have lost two members by death[1]—Dr. J. C. Mulhall, of St. Louis, and Dr. H. B. Moore, of Colorado Springs.

[1] Dr. Rufus P. Lincoln, a member of this Association since 1890, died at his home in New York City, after an operation for appendicitis, on November 27, 1900. Dr. Lincoln was a graduate of Amherst College, 1862, and of the Medical Department of Harvard University, 1868. Dr. Lincoln was widely known and highly regarded for his sterling qualities as a gentleman and as a practitioner.

Dr. Mulhall was elected in 1890, and contributed valuable papers on influenza, simple serous recurrent pleural effusion, and traumatic cardiac neurosis, which were published in the eighth and eleventh volumes of the TRANSACTIONS. Dr. Mulhall was very highly esteemed in St. Louis, and was well known throughout the country for his high scientific attainments. His personal character was attractive, and by his death we have lost a valuable and honored member. One member has been removed from the roll by reason of non-payment of dues.

There are eight applications for membership. Of these the Council has recommended five for election. Full information has been furnished each member regarding the candidates.

The receipts during the past year have been as follows:

Balance on hand May 10, 1899 .	$176 92	
Received from dues . . .	720 00	
Received from other sources .	18 50	
Total		$915 42

Expenditures:

Vol. XV. TRANSACTIONS . .	$629 84	
Other expenses	187 80	
		817 64
Balance on hand		$ 97 78

The large amount spent for the TRANSACTIONS and other expenses are not easily met unless dues are promptly paid. There are over two hundred dollars outstanding, much of which is for the present year, and will no doubt soon be largely paid. There are no debts owing by the Association at the present date. The Treasurer begs to inform the Association that it will take a membership of 150, with dues fixed as at present, to properly conduct the finances of the Association.

The TRANSACTIONS have been forwarded to members of all grades and to journals and libraries in this country and abroad. In distributing to foreign countries we have had, as heretofore, the advantage of free transportation through the Bureau of International Exchanges of the Smithsonian Institution, to which we return thanks. The following works have been received:

La Vie sur Les Hauts Plateaux. By Prof. A. L. Herrera and Dr. D. Vergara Lope. Mexico: 1899. 8vo., pp. 790.

Climatologie Médicale de la Republique Argentine. By Dr. Samuel Gache. Buenos Ayres: 1895. 8vo., pp. 917.

La Tuberculose dans la Republique Argentine. By Dr. Samuel Gache. Buenos Ayres: 1899. 8vo., pp. 356.

Public Health Reports. Treasury Department, United States Marine Hospital Service, Washington, D. C.

Water Supply and Irrigation Papers. United States Geological Survey, Nos. 32 and 33.

Report of the Chief of the Weather Bureau, 1897–98.

Albany Medical Annals.

Bulletin of the American Academy of Medicine.

Bulletin of the Royal Academy of Belgium.

Transactions of the Association of American Physicians, 1899.

Transactions of the American Laryngological Association, 1899.

State Hospitals Bulletin, New York.

Experiment Station Record, Washington, D. C.

Sitzungsberichte des Aerztlichen Vereins Munchen, ix., 1899.

Transactions of Texas State Medical Association, 1899, 1900.

Transactions of the North Carolina State Medical Association, 1899.

Transactions of the South Carolina State Medical Association, 1899.

The Secretary then made a report of the meeting of the Council at 110 West Thirty-fourth Street, New York City, on January 12, 1900.

The Council has received invitations for the Association to meet in 1901 at Coronado Beach, California, and at Palm Beach, Florida.

Business Meeting at 12.30 p.m.

Drs. Curtin and Denison were named by the President to serve as an Auditing Committee.

After calling of the roll the following gentlemen were named to serve as a Nominating Committee: Drs. Davis, Otis, Curtin, Coleman, and Hinsdale.

Dr. Coleman said he wished to offer a resolution in opposition to the Gallinger anti-vivisection law, which had recently been brought up in Congress.

Dr. Otis said that at a previous meeting of the Association this

question had been brought up and a committee had been appointed, consisting of Dr. Knight and himself, to investigate the matter. Since then, Dr. Otis said, he had heard from Dr. Sanders on the subject, and he did not think it was necessary for the Association to take fresh action regarding the matter.

Dr. Otis was informed that the Gallinger bill, against which this resolution was aimed, was a new bill.

Dr. Wilson said the general feeling was that it would be desirable for all the medical bodies to adopt resolutions urging Congress not to pass the bill.

Dr. Minor suggested that the local medical societies could exert more direct influence by petitioning their respective Representatives in Congress.

Dr. Babcock said he was sorry to learn that one of the esteemed members of the Association, Dr. Knight, of Boston, was detained at home by illness. He moved that the Secretary be instructed to send a telegram to Dr. Knight, expressing the regret and sympathy of the Association and the hope for his speedy recovery. Unanimously adopted.

The Secretary announced that the dinner of the Association would be held at 7.30 in the evening. After the dinner all the members were invited to attend a "smoker" at the Cosmos Club.

Second Day—Wednesday, May 2d.

Meeting called to order at 12.30 P.M.

Dr. Denison moved that the scientific programme on the following day be commenced at nine o'clock instead of ten, so that all the papers could be read. Carried.

The Secretary stated that the following places had been suggested to the Council from which to select a place of meeting next year: Coronado Beach, Cal.; Palm Beach, Fla.; Aiken, S. C.; Augusta, Ga.; Mackinaw, and Niagara Falls. Council has decided to allow the Association to decide where it shall meet.

After considerable discussion it was moved and seconded that this question be referred back to the Council for decision. Carried.

Dr. Otis moved an amendment to Article III. of the By-laws, which states that the annual dues shall be $5. The amendment

consists in the addition of the words: "The initiation fee shall be $10." Seconded; carried.

Dr. Otis said that last year it was voted to give the Secretary $50 for employing clerical work. He moved that the same sum be appropriated for this purpose the present year. Seconded; carried.

The Secretary announced that on the following afternoon Dr. Abbot, of Washington, would provide a special train for the members for the purpose of visiting Mount Vernon.

It was moved and seconded that a vote of thanks be accorded to Dr. Abbot for his kindness. Unanimously adopted.

It was moved and seconded that the Secretary send a telegram to Dr. H. D. Didama, of Syracuse, expressing the sympathy of the Association with him in his affliction. Carried.

Third Day—Thursday, May 3d.

Meeting called to order at 12.30 P.M.

The Secretary read a letter from Dr. Knight.

The election of members then took place by individual ballot.

The Secretary asked permission of the Association to furnish Dr. Gould with fifty copies of the Transactions or as many as may be required to medical libraries throughout the country. This was granted.

The President said that the Association was represented on the National Committee for the International Congress, which meets in Paris next summer, in the person of its President. The following arrangement had been made: The National Committee was constituted of the President of the Congress of American Physicians and Surgeons, of the Presidents of all the Associations which composed the Congress, of the President of the American Medical Association, and of the representatives of the Army, Navy, and Marine Hospital Corps. There is an expense connected with this of $450, and it was desired that each Association contribute $25 toward the expenses of the American National Committee of the International Congress. Seconded; carried. (Amount forwarded.)

The Secretary announced that it had been recommended that the membership of the Association be limited to 150. This

comes before the Association as a change in the Constitution, and would have to be acted upon at a subsequent session.

Dr. Otis said the next meeting of the International Congress on Tuberculosis was to be held in London. He thought the Association ought to be represented there. He moved that the Council be authorized to appoint one or more delegates to attend this Congress. Seconded; carried. Dr. Jacobi and Dr. Coleman were appointed delegates to the Congress.

The tellers announced that all the gentlemen whose names had been voted upon had been elected, viz.:

Dr. Horace D. Arnold, Boston.
Dr. Thomas W. Harvey, Orange, N. J.
Dr. Henry Jackson, Boston.
Dr. Charles E. Nammack, New York.
Dr. F. Savary Pearce, Philadelphia.
Dr. Alfred Stengel, Philadelphia.

The Nominating Committee then made its report, and the following officers were elected for the ensuing year:

President, Dr. R. H. Babcock, of Chicago.

Vice-Presidents, Dr. A. C. Peale, of Washington, D. C; Dr. S. W. Langmaid, of Boston.

Secretary and Treasurer, Dr. Guy Hinsdale, of Philadelphia.

Member of Council, Dr. A. Jacobi, of New York.

Dr. Babcock moved that a vote of thanks be extended to the President, Dr. Jacobi, and the Secretary, Dr. Hinsdale, for the efficient manner in which they had carried out the duties which devolved upon them. Unanimously carried.

After a gracious response by the President the Association adjourned until 1901.

GUY HINSDALE,
Secretary.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

Article I.—Name.

This Society shall be known as the American Climatological Association.

Article II.—Object.

The object of this Association shall be the study of *Climatology and Hydrology and of Diseases of the Respiratory and Circulatory Organs.*

Article III.—Membership.

Section 1.—This Association shall consist of *active, corresponding,* and *honorary* members, the latter not to exceed ten.

Sec. 2.—Names of candidates for active membership, whose applications have been indorsed by *two* (2) active members, shall be sent to the Secretary at least thirty (30) days before the annual meeting. On approval of the Council, the applicant shall be balloted for at the annual meeting. Three (3) black balls shall be sufficient to reject a candidate. The Council shall have power to nominate active members.

Sec. 3.—The power of nominating honorary and corresponding members shall be vested in the Council. The election shall be conducted in the same manner as that for active members. Honorary members shall enjoy all the privileges of active members, but shall not be allowed to hold any office or cast any vote.

Sec. 4.—Any member of the Association absent from the meetings, in person or by contributed paper, for three (3) con-

secutive years, without sufficient cause, may be dropped from the list of members by vote of the Council.

Article IV.—Officers.

Section 1.—The officers of this Association shall consist of a *President*, two *Vice-Presidents*, a *Secretary and Treasurer*, who, with five other members and the delegate and alternate to the Executive Committee of the Congress of American Physicians and Surgeons shall constitute the *Council* of the Association.

Sec. 2.—Nominations. The officers, including the Council, shall be nominated by a committee of five (5) members, which committee shall be nominated by the President at the first session of each annual meeting, and shall report at the business meeting.

Sec. 3.—Elections. The election of officers shall take place at the business meeting. A majority of votes cast shall constitute an election.

Sec. 4.—The President, Vice-Presidents, Secretary and Treasurer shall enter upon their duties at the close of the annual meeting at which they are elected, and shall hold office until the close of the next annual meeting, or until their successors are elected.

Sec. 5.—Members of the Council, other than the President, Vice-Presidents, Secretary and Treasurer, shall hold office for five (5) years.

Sec. 6.—Vacancies. Any vacancy occurring among the officers of the Association during the year may be filled by the Council.

Article V.—Duties of Officers.

President and Vice-Presidents.

The President and Vice-Presidents shall discharge the duties usually devolving upon such officers. The President shall be *ex-officio* Chairman of the Council.

Secretary and Treasurer.

As Secretary, he shall attend and keep a record of all the meetings of the Association and of the Council, of which latter

he shall be *ex-officio* Clerk. At each annual meeting he shall announce the names of all who have ceased to be members since the last report. He shall superintend the publication of the TRANSACTIONS, under the direction of the Council. He shall notify candidates of their election to membership. He shall send a preliminary notification of the annual meeting two (2) months previous thereto, and the programme for the annual meeting at least two (2) weeks previous to its assembly, to all the members of the Association. He shall also send notification of the meetings of the Council to the members thereof. At each annual meeting of the Association he shall read the minutes of the previous meeting and of all the meetings of the Council that have been held during the current year.

As Treasurer, he shall receive all moneys due, and pay all debts therewith. He shall render an account thereof at the annual meeting, at which time an auditing committee shall be appointed to report.

ARTICLE VI.—COUNCIL.

The Council shall meet as often as the interests of the Association may require.

Four (4) members shall constitute a quorum.

It shall have the management of the affairs of the Association, subject to the action of the Association at its annual meetings.

It shall consider the claims of candidates recommended to it for admission to membership.

It shall not have the power to make the Association liable for any debts exceeding in total one hundred dollars ($100), in the course of any one year, unless specially authorized by a vote of the Association.

It shall have the entire control of the publications of the Association, with the power to reject such papers or discussions as it may deem best.

It shall have power to nominate active members at the annual meeting.

The Council shall have power to invite any gentleman, not a member, to read a paper at the annual meeting, on any subject within the scope of the objects of this Association.

The Council shall determine questions by vote, or—if demanded—by ballot, the President having a casting vote.

The Council shall constitute a Board of Trial for all offences against the Constitution and By-Laws, or for unbecoming conduct, and shall have the sole power of moving the expulsion of any member.

The President, or any two members, may call a meeting, notice of which shall be transmitted to every member two (2) weeks previous to the meeting.

Article VII.—Papers.

Section 1.—The titles of all papers to be read at any annual meeting shall be forwarded to the Secretary not later than one (1) month before the first day of the meeting, in order to appear on the printed programme.

Sec. 2.—No paper shall be read before the Association which has already been printed or been read before another body.

Article VIII.—Quorum.

A quorum for business purposes shall be ten (10) members.

Article IX.—Amendments.

This Constitution may be amended by a four-fifths ($\frac{4}{5}$) vote of all the members present at an annual meeting, provided that notice of the proposed amendment has been printed in the notification of the meeting at which the vote is to be taken.

BY-LAWS.

1. Meetings of the Association shall be held annually.

2. The time and place of the meetings shall be determined by the Council.

3. The dues of active members shall consist of an annual assessment not to exceed five ($5) dollars. The initiation fee shall be ten ($10) dollars. Members in arrears shall not be

entitled to vote. Those in arrears for two (2) years may be dropped from membership by recommendation of the Council.

4. Order of business meeting.

First day:

Calling the roll of members;
Minutes of previous meeting;
Treasurer's report;
Appointment of auditing committee;
Appointment of nominating committee;
Report of Council on recommendations for membership.

Second day—Morning session:

Report of nominating committee;
Election of officers;
Election of members;
Report of the committee on health resorts;
Miscellaneous business;
Adjournment of business meeting.

Any of these By-Laws may be amended, repealed, or suspended by a two-thirds vote of the members present at any meeting.

PRESIDENT'S ADDRESS;

FUNCTIONAL AND ORGANIC HEART MURMURS IN INFANCY AND IN CHILDHOOD.

BY ABRAHAM JACOBI, M.D., LL.D.,

NEW YORK.

I ASK your permission to utilise the time afforded me for a presidential address by discussing a few points connected with cardiac murmurs, both functional and organic, mainly in infancy and in childhood. In the last volume of the *Transactions* of our Association, I published a paper on functional cardiac murmurs. I avail myself of this opportunity to again return to the same subject with a single contribution which I think of some importance. On that occasion I quoted a remark of mine of the year 1888 (*Brooklyn Medical Journal*, March) which reads: "The heart (of the infant) exhibits functional murmurs but rarely. Whenever there are murmurs present in the infant, it is safe to attribute them to organic disease rather than to mere functional disorder." The last few years have produced many contributions to the same subject, particularly in Germany. Two authors of eminence, Hochsinger and Soltmann, deny absolutely the occurrence in the first three years of life of functional murmurs. The persistent discussion of these statements, both in societies and in the journals, have, however, brought out a few instances of a murmur in the very young that may well be taken as functional. One of them I quoted last year. After all, it appears undeniable that even a single case contradicting the categoric

dicta of the two eminent workers is capable of shedding light on a difficult topic.

Helen D. (coloured), thirteen months of age, rachitic, was admitted to the "Jacobi Ward" of Roosevelt Hospital, March 19, with pneumonia and some pus cells in the urine. The last physical signs of pneumonia disappeared about April 6; on the 10th there was some vaginal discharge but no gonococci were found. It disappeared after a few days. All this time there were marked remissions in her high temperature, the thermometer showing 105° F. and more in the evening, and less than 101° F., down to 99° F., in the morning. Plasmodia were not found, in spite of renewed examinations which were made before quinine was administered. Large doses of the latter were then given daily up to 10 grains a day, also subcutaneous injections during the remission. Careful search for pus everywhere was negative. On April 10 a systolic murmur was heard which gradually increased and fortified the diagnosis of septico-pyeluria. Then, while quinine was continued, Credé's ointment, 1 gramme daily, was used; within a day the temperature fell to 102° F. in place of 105° F., and the child appeared comfortable for some days, smiled and took food. At no time could pus be discovered. There was no dulness, and respiration had become normal with absence of any physical changes or symptoms. The murmurs grew less and could not be found on April 17, nor afterward at any time. About the same time the temperature rose again and exhibited the same steep curves of previous weeks. The infant was evidently sinking and could not be examined closely during the last six days of her life. She died on the 23rd. The autopsy revealed a recent suppurative pleurisy of the right side, surely a few days old only, and absolutely no other abscess or ulceration. The cause of the pyæmic fever is unknown to me. But the subject of greatest interest to me was the heart. Here was an infant with sepsis, with a marked systolic murmur that took a few days to become quite loud;

then it gradually diminished and was absolutely lost during the last six days of life. A close examination of the heart by the pathologist of Roosevelt Hospital, one of the gentlemen connected with the Pathological Department of Columbia University, revealed positively nothing abnormal in the heart. So here was a functional mitral murmur in a baby of thirteen months of age.

Neither it nor an organic murmur should, however, be mistaken for extracardial murmurs. I have seen that error committed. Extracardial murmurs in children, mostly systolic, are very infrequent in infants below two years, because at that early time the heart is larger in proportion and less covered by the lungs. When these grow, however, and in the presence of a tumour or of adhesions between the pleura and the pericardium, the murmur appears, soft or grating; is mostly heard anteriorly only; is arhythmic, not synchronous with the contraction of the heart; is strong on deep inspiration; disappears when there is no breathing, and is less audible in a recumbent than in an erect posture.

Hochsinger terms extracardial those murmurs which are now and then observed in grave anæmia, mainly leucocythæmia, and not infrequently with rachitic deformities of the heart. It will not do, however, to be over-consistent. In grave anæmia we might well think of the myocardial structure-changes which result in irregular contraction; and in rachitis the more extensive contact of the heart with the ill-shaped chest annoys the heart-muscle sufficiently to impede symmetrical contraction.

If murmurs mean organic valvular disease in most cases, the latter does not necessitate the presence of a murmur. Mitral stenosis need have no murmurs at all. Osler long ago emphasised the fact that ulcerous endocarditis may not exhibit any murmur, and that the diagnosis of the condition is thereby rendered difficult. I have seen proofs of that statement in autopsies. When the deposits take place at the

insertion and not at the edge of the valves, there is, or need be, no murmur. Two months ago I lost a child two years of age who was under close observation six weeks for pneumonia, endocarditis, and finally, meningitis of which he died. This endocarditis was diagnosticated by the usual symptoms and was marked by a loud systolic mitral murmur. The patient was in a fair way to recover from his endocarditis (pneumonia having disappeared before the heart was affected), when meningitis developed. During that recovery the murmur became gradually less from day to day until it disappeared entirely. There was certainly an apparently complete recovery from endocarditis. The specimen which I shall exhibit to you before the end of the session shows still a slight thickening of the edge of the mitral valve and isolated small thickenings at a little distance. But for these findings the murmur might have been classed as functional ; as it is, there is merely a proof that a partial, probably also a complete, recovery from endocarditis may take place. That happens, perhaps, more frequently in the very young than in advanced years. For although endocarditis is very frequent at an early age, valvular lesions are mostly—but mostly only—milder than in the adult, and compensation is easier. Moreover, murmurs are not so apt to be loud, because the vessels are relatively wide compared with the heart. At about puberty the relation of the width of the blood-vessels to the volume of the heart is 61:290, while in the newly-born it is 20:25, viz., almost identical.

What I said of the possibility of a *bonâ fide* recovery from endocarditis is mainly due to the changes I alluded to last year. I spoke of Bouchut's proliferating endocarditis (*endocardite végétante*), called valvular nodes by Albini, blood-cysts by Luschka and Parrot and lately (1898) blood-nodules by Berti. They are small elevations, principally on the lower side of the valves, and give rise to a systolic mitral murmur in the newly-born, which may either last a lifetime or disappear in time with the growth of the organ, or with increasing absorption, or with progressing compensation.

Endocarditis is not always easily diagnosticated. That there may be valvular lesions without a murmur, I think I have shown. However, endocarditis does not necessarily mean valvular lesion, nor does it necessarily imply dilatation and accentuated pulmonary sound; nor is it followed, at least for years, by obstructions and disturbance of compensation, for in the very young the right ventricle is more muscular, expels its contents more readily into the blood-vessels, which are still disproportionately wide, and thus protects the auricles against dilatation. But what endocarditis does accomplish in many innocent-looking cases is through its complication with myocarditis.

Most murmurs mean organic lesions either in the valves or in the myocardium. In that respect all ages are alike. But there are possibilities in the infant which modify the explanation of the usual observations, and there are conditions in which the diagnosis may be very difficult. For instance, besides the frequent mitral systolic murmurs that result from infectious diseases, most commonly from rheumatic invasion, there are those that originate in contraction, or more or less obliteration of the mitral orifice, or adhesion of the valve. These conditions are not always complicated. There is, for instance, the case of Gerhardt, that of a baby who died at the age of four months. Still, they are very rare, very much more so than in the pulmonary artery, or even in the aorta where some have been noticed and ascribed to syphilis.

In persistence of the ductus arteriosus Botalli there is a loud systolic murmur over the sternal end of the second left intercostal space. It extends upward into the vessels of the neck mainly of the left side and is audible posteriorly in the left interscapular space. It is connected with a characteristic dulness nearly oblong, extending along the left margin of the sternum to the clavicle. Within a few months lately I have seen two cases in which the diagnosis was obvious. But uncertainty may arise when there are complications with

valvular anomalies (either rudimentary development or excrescences) or with interauricular communications, or with stenosis or atresia of the aorta or of the pulmonary artery, or with a narrow bicuspid orifice. These complications are more dangerous than the patency of the channel itself, because the number and degree of accompanying conditions, such as extensive murmurs, cyanosis, and hypertrophy of the right ventricle, depend on them. When not so complicated, patency of the duct is compatible with a fairly long life.

In congenital stenosis of the pulmonary artery there is in the sternal part of the second left intercostal space a systolic murmur which is not transmitted into the carotid, except when there is a complication with defects of the ventricular septum. It may be mentioned that the second pulmonary sound is feeble, that there is cyanosis with clubbed fingers and hypertrophy and dilatation of the right ventricle. These are not present when, instead of stenosis, there is a complete atresia of the artery. In that case the right heart is small or rudimentary.

Absence of the ventricle I have never seen or diagnosticated, unless complicated with stenosis of the pulmonary artery. In these latter cases there is a loud murmur over the sternum which extends far down and upward into the vessels of the neck. The secondary pulmonary sound is accentuated only when there is a hypertrophy of the right ventricle ; when both ventricles are hypertrophied the second aortic and pulmonary sounds are of equal strength. The frequent statements in the books that pulmonary stenosis with defect of the septum is characterised by hypertrophy of the heart, I cannot verify. On the contrary, the absence of much hypertrophy I find to be characteristic of that condition ; it has led me to a correct diagnosis which I could verify by the autopsy. The record of one such case may be found in the *Archives of Pediatrics* of a number of years ago.

Another class of cyanotic cases owes its origin to an arrest

of development of the common arterial trunk which did not separate into the aorta and pulmonary artery. In these cases, contrary to many statements, I found but little hypertrophy or dilatation, sometimes none at all. The loud murmur is heard over the sternum a little to the right and to the left, about the insertion of the second and third ribs; it is very audible posteriorly, but much less than anteriorly.

Very loud murmurs, audible at a distance, without the ear touching the chest, I have heard more in adults than in children, without having an opportunity to make an autopsy. They are always systolic and are mostly attributed to hypertrophy and believed to be muscular only. In a few cases, however, I am certain that no increase of percussion dulness or of cardiac impulse corresponded with the loudness of the tone; so I was inclined to believe that the peculiar phenomenon was due to torn and swinging papillary muscles. Not infrequently the general condition of the patient is vastly better than the formidable noise would appear to suggest.

Organic murmurs, when present, are not always audible. They may not be heard at all when the heart-beats increase in number. Then the blood-wave is small and the excursion of the valve short. Diminution of temperature, or a few doses of digitalis, therefore, restore a murmur which was temporarily absent; but under ordinary circumstances also, as I said before, an organic murmur may disappear for two reasons, one of which is recovery, the other compensation. I think I proved that the disappearance of a murmur, as, for instance, in Case III. and Case IV., described by Starck in *Arch. f. Kind.*, 1900, p. 200, does not prove it to be functional. Nor is there any reason why an endocarditic thickening should not be absorbed as well as those on other tissues.

A few words only on myocardial changes. About middle-age myocardial changes are mainly caused by everything that gives rise to hypertrophy and dilatation. We find mostly a diffuse increase of the intermuscular connective tissue with

atrophy of the muscular tissue which first was hypertrophic The senile heart is very apt to exhibit hypertrophy and dilatation of a peculiar type. There is atheromatous degeneration of the coronary and the minute nutrient arteries. There is consequently an annoyance or destruction of the lymph interstices and channels in and on the myocardium, and of the two large trunks that carry the myocardial lymph to the mediastinal lobes, and finally, degeneration of the myocardium resulting in either macroscopic, more or less local, thickening or in atrophy. That is why the contraction of the organ is liable to be irregular and partial, in instalments, as it were, although there be no accompanying sclerotic alteration of the pericardium, or thickening of the valves and of the endocardium.

What we call debility of the heart is a symptom of a great many different conditions. There is a congenital atrophy which is liable to lead to lipomatosis, there are intoxications by infectious diseases, alcohol, syphilis, malaria and tuberculosis ; nutritive disorders, such as rachitis and scrofula, over-exertion and premature schooling with constipation, and subacute and chronic nephritis, one of the most frequent and most frequently overlooked diseases of early infancy. I mention only those causes of myocardial acute, subacute or chronic changes that are most common in the young, but should emphasise that what is called debility or failure at any age is in all the cases so occasioned not functional, but the result of organic lesions. Two most interesting cases of heart debility I found connected with purpura. Only in one could I obtain an autopsy. There were numerous blood-points in the walls of both ventricles and a livid appearance of the muscle.

In infants and children myocarditis is mostly parenchymatous.

Most intense and persistent myocardial changes are found after influenza and after diphtheria ; they are most injurious at about puberty—fortunately, however, diphtheria is not so

frequent at that age—when the heart is no longer disproportionately strong and large, than in earlier years. Schmalz reports 81 cases of chronic cardiac disorder originating in 500 cases of diphtheria. In some seasons—for instance, in the severe New York epidemics of 1870 and 1874—the proportion was much larger. In many arhythmia and murmurs last for life; they may be modified by a protracted recumbent position during convalescence, and by resorting to absolute rest extending over weeks whenever increased cardiac disturbance is observed. The systolic murmur is *extensive*, but mostly heard in the mitral and pulmonary regions, at the same time that now and then there is an increase of transverse dulness. But more characteristic than the extensive murmur, which often by the absence of localisation facilitates the differential diagnosis, is the irregularity of the contraction of the heart. The condition of the heart-muscle changed by myocarditis (parenchymatous or hyperplastic, it makes no difference) is not uniform. Neither a kidney nor the myocardium is equally affected and changed in all its parts. That is why arhythmia is so frequent. No matter how many causes, either in the heart or nerves or distant organs, are charged with causing it the most frequent cause is chronic myocarditis.

A peculiar form of arhythmia mostly complicated with a murmur is the duplication of one of the heart-sounds. It is not always easy to distinguish which of the sounds it is that is so affected. Now and then we hear a dactylus—uu, in other cases or at other times an anapestus uu—. The cause of this gallop-rhythm must be either in the myocardium or in the valves. From careful and long observation of individual cases, and from the improvement that rest alone is able to work on the case in regard to the annoying symptoms, there is no doubt in my mind that it is the former. The first sound appears to slit up when the two atrio-ventricular valves are not working simultaneously, the second, when the aortic and the pulmonary valves do not act together. This lack of syn-

chronicity, however, depends on the lack of muscular myocardial coaptation. A similar symptom may be had in mitral stenosis, particularly after a slight exertion, and in hypertrophy and dilatation of the right ventricle when the valves close in different times.

The gallop-rhythm is a suspicious symptom inasmuch as it proves the exhaustibility of the heart-muscle. I kept the children in bed for months, and a single exertion sufficed to renew or to increase the duplication. Thus, a long rest is required and attention to general hygiene, food in small and digestible quantities, and regulation of the bowels. In most cases iodide of potassium is indicated and strychnine or some other cardiac stimulant. Strychnine should not be feared, because it should not be forgotten that parts of the heart are probably in an intact or nearly intact condition, and permit of stimulation. If that be done carefully, the galloping rhythm ceases to be such a bad omen as some declare it to be.

Clara R. was discharged June 8, 1899, after having been in the hospital for chorea. This returned about the end of January, 1900; she then had pneumonia, from which she recovered. She was readmitted March 3, 1900, with chorea mostly of the right upper extremity, very irregular heart-action, dulness reaching more than one centimeter beyond the right margin of the sternum, while in an erect position, and marked duplication of the second sound at the apex and to the right of it. The impulse was feeble. Radial pulse small. Muscular power generally feeble, with costiveness, and at one time incontinence of urine resulting therefrom. The latter was almost suddenly relieved by increasing the doses of $\frac{1}{100}$ of a grain of strychnine to $\frac{1}{50}$ of a grain, three times a day. When her general strength improved and her colour brightened, the duplication disappeared gradually; but whenever her condition appeared worse, under the influence of a low barometer, for instance, it would reappear. She was kept in bed and was discharged April 16, without her duplication,

and with her heart not reaching beyond the median line of the sternum when in a sitting posture.

This Association fills a place peculiarly its own. Its aims and objects appear sympathetic to every physician who is more than merely an anatomist or pathologist, and better than a mere prescription-writer. The class of philosophic doctors whom Hippocrates calls "godlike" because he says they strive to learn the connection of things, belongs here. The climatic and atmospheric influences of Nature on man, mainly as they affect the human creature through the respiratory and circulatory organs, is the object of your study. That is why there is, and should be, a peculiar incentive to become a member and why the applications for admission were always very numerous, and the roll of membership has become large. We have been very fortunate in not losing by death any of our members, except Dr. J. C. Mulhall, of St. Louis, and Dr. H. B. Moore, of Colorado Springs, whose loss we have to deplore.

The danger of swelling the ranks too rapidly is very great indeed. This year, however, we are singularly fortunate in the character and standing of our candidates. In connection with this matter, it is hardly necessary to point to and to emphasise the established policy of the Association to admit only men whose position is established or who through at least a few publications connected with our study have proved their right to apply.

Feeling as I do that contributions should be spontaneous unless there be a preparation for a set discussion, I felt a few months ago that there might not be a sufficiency of material for your meetings. I was happily mistaken, for there is ample work for you. The American democratic spirit has prevailed again.

THE MODERN PHYSICIAN'S DUTY TO PATIENTS SUSPECTED OF HAVING PULMONARY TUBERCULOSIS.

BY FREDERICK I. KNIGHT, M.D.,

BOSTON.

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(1) To make a positive diagnosis as early as possible.

It might seem unnecessary to urge this proposition, as it would appear to be the duty of every physician to make at once as exact a diagnosis of every case as possible—for his own guidance, if for nothing else; but it is painfully evident to all consultants, that this is not done. This arises in part from carelessness, and in part is an inheritance of the old plan of waiting until some characteristic symptoms of consumption showed themselves before doing anything; while some patients who become infected may recover without any special care or treatment, it is our duty to see that every infected person who consults us has at least the opportunity to change his condition or submit himself to treatment at once, as the chances of arrest of the disease are so much greater the earlier it is taken in hand.

(2) To inform the patient of the gravity of the situation; not that he is in consumption, but that he is tuberculous and liable to become consumptive, but also that he has a good chance to recover if he pursues the right course. Formerly there has been great reluctance to inform the patient of the nature of his disease, if he was tuberculous, because it was considered almost surely fatal, and the patient's apprisal of

its nature only hastened the course of the disease. Since pulmonary tuberculosis has been known to be curable in its early stages, and the more readily curable the earlier it is taken in hand, it has been found that the coöperation of the patient, which is very necessary to his treatment, can only be obtained by his apprisal of the serious nature of the disease. There may be exceptions to this rule, but the very patients from whom, on account of temperament we would be inclined to exclude a knowledge of their disease, oftentimes when told it made the best and most tractable subjects, working with great fidelity to bring about a cure.

(3) To put the patient at once on the best course available in his particular case for an effort at recovery. This must vary immensely, according to the nature of the case, the character of the patient, his family and other relations, and his financial condition. The physician should make up his mind, if possible, exactly what to advise without discussing the *pros* and *cons* of different plans with the patient. He should find out from other members of the patient's family about what the patient is able to do; thus avoiding the suggestion to the patient of what is impossible, for financial, or other reasons, which might naturally have a depressing effect upon him. There is nothing which, as a rule, pleases a patient more than to have the doctor make up his own mind what is best to be done without obliging him to decide for himself between half-a-dozen different propositions. Many patients, perhaps a majority, will do better to pass the first six months, at least, in a sanatorium. Here they will learn to take care of themselves as they can nowhere else. Their *morale* will be much improved. The possibility of recovery is realised here as nowhere else. If a sanatorium is decided on, shall it be one near home, or far away in a much better climate? The combination of the best climate and a sanatorium offers the ideal method of treatment, but many considerations come in to make the patient prefer to remain

near home, and the results of treatment in sanatoria near home certainly make a good showing. If the patient has no fever, but simply cough of short duration, slight expectoration (showing bacilli on examination, but perhaps no elastic fibres) and slight physical signs, he may, in some cases, if a man of good sense, be allowed to travel, or take a long sea-voyage. It may be necessary for him to remain in his own home, and here, if he submits to a *regimen* similar to that of the sanatorium, he may recover. The chief difficulty in a city is to devise any way to keep the patient sufficiently in the open air without too much exercise; it has been found however, that even in New England much more can be accomplished in this regard than was supposed possible a few years ago, patients even passing the nights outdoors six months of the year with great benefit (Millet).

(4) To provide that the patient shall be all the time under the care of a medical man who is familiar with the modern treatment of the disease.

DAMPNESS OF THE SOIL AS A FACTOR IN THE PRODUCTION OF HUMAN TUBERCULOSIS.

BY RICHARD COLE NEWTON, M.D.

If an apology be needed for taking up the time of the Association with the histories of a few cases of tuberculosis, and an imperfect and crude discussion of the points which the cases seem to emphasise, I think that the importance of the subject chosen will provide the excuse.

I will first recite a few family histories which have come under my observation.

The D family, Germans, of vigorous stock. No cases of phthisis have been known to occur among the ancestors of this family for generations. Father, a farmer, died of some non-tubercular trouble, at a good old age. Mother living, over 70, and in good health. They had twelve children. The firstborn, a son, is now living and in good health. When he was one year old the family moved into a small stone house, now standing, which was exceedingly damp. Eleven children were born in this house in the eleven years during which they lived there. Then they moved into another house which they had built on the same premises. It was built of wood, was much less damp than the first one, but had too many shade trees around it. The second child, a female, died of consumption "following grippe," at 39. The third child, male, died at 37 of apoplexy. The fourth child, male, died at 40, of consumption "following grippe." The fifth child, female, had consumption, for which she went into Sullivan Co., New York

State. This change of residence, she says, saved her life. She has lost a child from tuberculosis, and is herself still suffering from chronic bronchitis. The sixth child, female, died at 26, of pneumonia. The seventh child, female, died at 27, of consumption, "following grippe." The eighth child, a male, is living and in good health, at 36. The ninth child, a male, is living, and in good health, at 34. The tenth child, a male, is living and in good health, at 32. The eleventh child, a female, died in childbed. Had a diarrhœa for four weeks after the baby came, and had had a cough. Not known to have had lung trouble. The twelfth child, male, died at 18, of dropsy. No cough. Said to have fallen and "bruised his liver."

C family, Irish labourers and carpenters; lived in a damp house. Their kitchen was in the basement and there the family lived a great part of the time. The children were frequently seen lying in their cradles in the basement. No phthisis so far as known amongst ancestors. Father and his sister, and mother's sister now living. Mother died of heart disease. They had twelve children, all of whom except two died of consumption.

H family, Irish labourers. Father living, mother died of some disease not tubercular. Their house was built for them thirty years ago. They had three children living when they moved into it. The place was very damp. The fourth child was born there. In about twenty years the eldest daughter died of phthisis, aged 22. Seven years ago the son, a printer, died of phthisis, aged 31. In 1900 the youngest daughter died of phthisis, aged 27. One daughter, now living, has a sensitive throat and abnormally red cheeks.

B family, American. Explicitly deny all traces of phthisis among their known ancestors. The eldest daughter complained of cough, indigestion, nervousness, &c. Got well, after going into central New York to live. The second daughter, a teacher, has advanced tuberculosis, and is now in

Colorado Springs, under the care of Dr. Hart. Eldest son is anæmic and very "nervous." Younger son delicate, slender and pale. The house has been very damp. Now the surroundings have been improved by drainage.

These are all cases that have fallen under my personal observation. I dare say that by taking the experience of others the list might be indefinitely extended.

However, there have been enough cases cited to serve as a text for what I wish to say. I have long felt, as no doubt many other observers have, that something besides direct contagion by the reception of the tubercle bacilli into the body is necessary to establish the morbid process which we know as phthisis pulmonalis.

M. Jaccoud says :[2] "The tubercle bacillus belongs to a class of pathogenic microbes called "etiological dualisms," because they exist in healthy organisms indefinitely without injury to the latter and become noxious only in consequence of changes in the organism itself from other causes."

If this be so, the bacillus of Koch acts as we know that the Klebs-Loeffler bacillus, the pneumococcus and streptococcus act. That is to say, that it may be present in the human body and produce no overt symptoms. And it is reasonable to suppose that we are exposed over and over again to this infection. Perhaps our bodies never are free from the presence of the tubercle bacilli and yet only ten or twelve per cent. of the inhabitants of the Atlantic seaboard die of consumption. Why does not the entire race perish from this disease ? It may be said that the contagion is rather feeble and takes a long time to develop, and that the organism must be in a fit state to receive and nourish the germs, else they will not grow.

It is so easy to glide off into glittering generalities and to hide our ignorance under some half statement, or the plausible conjecture of some writer. It is a fortunate thing that we have at last adopted more exact methods of studying disease. Still, with all the care that has been bestowed upon the

study of tuberculosis there is still very much that requires elucidation.

Squire[3] and Kanthack[4] assert that some other influence or influences must be acting in conjunction with the bacillus before the latter can produce consumption in human beings. This being so the latter argues "That it is likely in practise to be far easier to remove the conditions causing this predisposition than to eradicate the bacillus so long as fitting conditions for its development are left. The problem then is no longer a matter of isolation and antiseptics, but of improved surroundings and better conditions of life." He mentions in this connection the divergent conditions regarding the behaviour of certain animals to anthrax infection. As for example, pigeons, which are usually resistant to anthrax, are rendered susceptible by starvation, and dogs, horses, pigeons and frogs, are made susceptible by being deprived of water. So a predisposition may be established in some animals by continued over-exertion, fatigue, loss of blood and by unsuitable diet. Guinea pigs and white mice, which are ordinarily resistant to avian tuberculosis, can easily be infected after being kept for a time in a warm chamber at 33° to 35° C. Precisely what changes are produced in the animals by these disturbances of their ordinary mode of life we do not know, we only know that whereas before we interfered the animal was insusceptible to the action of these various pathogenetic germs, afterwards it was easily infected.

"The war against tuberculosis then becomes a matter of sanitation rather than of disinfection and isolation, against the surroundings of the people rather than against a microbe, which can grow only when a predisposition is set up."

On the other hand, we have long known that under certain conditions the bacillus of Koch does little harm to the animal into which it may be injected. You will all remember Dr. Trudeau's rabbits. All of those which had been injected with the tubercle bacilli and allowed to run at large got well, while

all of those which were closely confined after inoculation died of tuberculosis. Perhaps one of the most conclusive experiments recently tried is reported from the Storrs Agricultural College in Connecticut.[5] Four cows were subjected to the tuberculin test in March, 1896, and did not respond. In October, 1896, they were again tested and all responded. They were then placed in a light, airy stable where it is estimated that each animal had 1,500 cubic feet of air space. In January, 1897, another test was made and all responded; but in April, 1897, after a test only two responded, and in July of that year none of them responded. For two years their milk was fed to eight healthy calves, only one of which contracted the disease, and that calf only showed evidence of tuberculosis six months after it had ceased drinking the experimental milk, so that the tubercular infection was probably due to some other cause.

Admitting, then, that the infection is well nigh universal and that it cannot become effective except under certain conditions, is it not our obvious duty to pay more attention to these conditions?

The whole trend of present scientific opinion is to minimise, if not to deny, the danger of tubercular infection in human beings from cows' milk. The discovery of the Timothy hay bacillus and its resemblance to the tubercle bacillus, has cleared up some of the threatened danger from the alleged discovery of the latter bacilli in milk, butter, &c., the bacilli so discovered really being the Timothy hay bacilli. Baldwin,[6] Guthrie,[7] Carr and Northrup,[8] Bouviard, Still,[9] Moore,[10] and others, are disposed to deny that the mode of infection by the bacillus is through cows' milk or other food; while Law,[10] Smith,[10] Park, Robison and others, believe that while there may be danger from infected milk it is small compared to the danger of infection from human consumptives.

And human infection itself is doubtless, as a general thing, comparatively weak. I will quote a few examples. Dr. Knopf[11] shows that the villages of Goerbersdorf and Falkenstein have

had fewer deaths from consumption since the sanatoria were established there than before. Dr. W. S. Searle[12] says that 2,286 patients have been treated in the Brooklyn Home for Consumptives during fifteen years. The number of employées beside the staff, is at present 21. Of these 3 nurses have been employed over three years. In not one of these employées has consumption developed. Dr. Solly[13] says that in spite of every neglect of hygiene and cleanliness in the poorer lodging houses at Colorado Springs, not over one case a year of tuberculosis originates there. Dr. Da Costa[14] had traced the histories of the doctors and nurses in the Pennsylvania Hospital for a period of seventy years, without finding a case of phthisis transmitted by contagion. In a discussion before the Glasgow Medico-Chirugical Society, Dr. Alexander Robertson and Mr. H. L. Clarke,[15] one from his long experience in the town hospital, and the other from his experience of surgical tuberculosis in the wards of the Royal Infirmary, stated that no case of infection among patients or attendants had come under their observation.

I think that we must agree with Professor N. S. Davis, junr.,[16] who says that if the bacillus of tuberculosis had been as infectious as that of variola and rubœla, the human race would long ago have become extinct. If, then, we have a feeble contagious element, which is apparently inoperative except under certain conditions, are we not neglecting our duty, if we do not more fully investigate the entire surroundings, including the conditions of the soil in those localities in which the disease is rife ?

As has been from time to time pointed out, the disease flourishes in some quarters of a town or settlement and will not flourish in others. Dr. L. F. Flick,[17] showed that for twenty-five years (1863-1887) all the deaths from tuberculosis in the fifth ward of Philadelphia occurred in less than one third of the houses. The famous communication of Dr. Bowditch to the Massachusetts Medical Society, in 1862, proved

beyond question the influence of the soil in the propagation of phthisis. The varying prevalence of the disease in certain localities he attributed chiefly to the dampness or dryness of the soil, and modern criticism has not been able to refute his conclusions. So also the fearful mortality from consumption in the German prisons has been shown by Baer and Cornet,[18] to be due in part, at least, to the damp and insanitary buildings. And Buchanan's[19] observations in England scarcely need comment, in which, for example, he showed that the general death rate for Salisbury had been reduced 9 per cent. by drainage; while that from phthisis had been reduced 49 per cent.; and in other localities the reduction of the death rate from tuberculosis was nearly as startling. Professor Welch[21] says, "although the nature of the relationship between the conditions of the soil and the presence of tuberculosis is not well understood, practical experience has shown that many localities have secured by good drainage great reduction from the mortality from this most deadly scourge of the human race. A reduction amounting in some places to nearly 50 per cent. of the former death rate."

I may have taken up too much time in endeavouring to prove what few will attempt to confute. But the great importance of the subject and the extreme desirability of drawing the attention of the profession and of the laity away from the contemplation of direct contagion by the bacilli, and of the contagiousness of milk and meat as the only dangers to be guarded against, must be my excuse. Buller,[5] Unterberger,[22] and Revillod,[23] point out that tuberculosis originates in certain areas in much the same fashion as other infectious diseases. It has, however, this difference, one class of people in a community will suffer from it and another will not. And people will contract the disease by a change in their habits or occupation as for example, "The percentage of Indian boys and girls that develop tuberculosis after giving up their out of door lives for the schoolroom is enormous."[24] "Tuberculosis in

all of its manifestations has increased among the Mexicans in the same ratio as among the Indians."[24] So also at present the American negro, at one time considered immune, suffers severely from this disease.

Dr. J. H. Girdner informs us[25] that in tuberculosis it is change rather than a particular climate that does good. He had spent the first twenty years of his life near Asheville, North Carolina, and could assert positively that the percentage of tuberculosis amongst the inhabitants of that region was fully as great as on Manhattan Island. His father, who had practised medicine in that region, was accustomed to send his tuberculous patients away from home to the seaside. Cases of tuberculosis in the Adirondacks are by no means rare amongst the natives, where poor food and unhygienic surroundings counteract the beneficial influence of the fine climate.

As Dr. Samuel West has wisely observed,[26] "it should be remembered that no climate is proof against the emanations of a filthy soil, either in city or country." And Dr. Robert Barnes, as long ago as in 1855, was a health official for a part of London, and wrote graphically of the dangerous properties of the superficial soil of cities, "the investigation of which," he asserted, "would solve some of the mysteries of high civic mortalities. After solving the problems of the water supply, the problems of the soil will become urgent, and as they too are solved life-saving will begin in good earnest." After speaking of the so-called "pest stratum," that is surface soil made up mainly of refuse organic matter, excreta, &c., he says, "If this 'pest stratum' could be kept dry, laden as it is with putrescent matter, it would be comparatively harmless. Moisture is a necessary element for the evolution of its pestiferous properties."

That disease is not engendered by a residence on the water itself is rendered very probable by the following facts. I still quote Dr. Barnes: "The population actually living on the

Thames, whose every breath is a distillation from its water, is not especially liable to fever, not so much so indeed as the population whose dwellings skirt the banks." Solly[28] says, "Apparently humidity of the air apart from other factors does not in itself produce phthisis. The comparative immunity from consumption among the men of the British navy contrasted with those of the army and the rarity of the disease in many islands, such as the Faroe, the Hebrides, the Shetlands and Iceland show this.

Referring back to the history of the "D" family, with which this paper began, we see that the second, fourth, seventh, and probably the eleventh and twelfth children died with tuberculosis. The fifth contracted the disease and probably still has it. All of those who escaped were males and were, of course, less in the house than their sisters. The oldest one was not born in the infected house, and the younger ones lived in it a very short time. They were all exposed to the same contagion and all lived under the same conditions. It seems to me that it is more reasonable to impute the high mortality of this family to the unsanitary condition of their residence than to any other cause. In other words, I think that the damp and polluted soil over which hey dwelt, supplied the necessary factors to make the inroads of the tubercle bacilli upon their bodies efficient. In the case of the "B" family, I think it more reasonable to impute the consumption that attacked Miss M. to her place of residence than to any other cause, and especially will this seem to be true, if after the improved drainage of the house the other children shall escape tuberculosis, particularly as they have been more or less exposed to infection from their sister.

Not to take up more time, I feel thoroughly convinced that I have proved my case, and that we had better, instead of expecting to annihilate the tubercle bacillus, turn our attention to altering the surroundings of our patients and correcting their vicious methods of life. We must agree with

the editor of the *Medical Record* who says, "The causes of the health-giving properties of a change of air are obscure; at any rate up to the present time they have not been explained." No doubt frequently all that is needed to arrest phthisis is that the vicious combination of a damp and polluted soil, want of sunlight and ventilation, together with poor food, and perhaps an unwholesome occupation, should be broken up by the withdrawal of one or more factors. The results of sanatorium treatment have so far been practically identical, so that while a life in Colorado is desirable, it is not necessary, to save at least a third of our incipient cases of phthisis. And while sunlight and life in the open air, pure milk, and a wholesome occupation are necessary and essential, a dry, properly constructed cellar to one's dwelling, which should be built over a pure, well drained, sandy subsoil, is just as essential to the alteration of the predisposition, so that the bacillus of Koch cannot gain a foothold in the human organism, as any of the means named. And it is our duty to insist upon this point over and over again until our patients shall cease to worry about milk and meat, and while not neglecting to burn tuberculous sputa, shall insist in living over properly constructed cellars and away from swamps, cesspools, sluggish streams and all stagnant and unwholesome bodies of water.

Colonel Wingate's remarks on this head are, to my mind, quite applicable, and I do not know that I can close this paper more fitly than by quoting them. He says,[30] "I am inclined to think that the health of the community is more affected by the sanitary state of the soil than by all other influences. If Manhattan Island could be thoroughly drained consumption would undoubtedly diminish."

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DISCUSSION.

Dr. Leonard Weber (New York): I have listened to this paper with much interest, and the conclusions which the author has drawn coincide very closely with the views held by those of us in New York who have done much hospital and dispensary work in the tenement house regions, where many of the very conditions prevail which Dr. Newton has spoken of. Here it is, perhaps, not so much the dampness of the soil as the dampness and ill ventilation of the houses. The tubercle bacillus, as we know, is a slow

worker; it is easily resisted, and cannot gain a foothold if the soil is not ready for its reception. About twenty-five years ago I visited the island of New Providence, Bahamas, which is one of the British West Indies, and world-famed as a health resort, the climate being especially favourable for patients suffering from tuberculosis. In the city of Nassau I met several physicians who were practising there, and one of them took me to a certain quarter of the city known as Grantstown, which was occupied largely by coloured people, and simply reeking with pulmonary tuberculosis. The houses of these people were situated on low ground, alongside of a sluggish watercourse, and all sanitary improvements were lacking. Here then we had an ideal climate for the cure of tuberculosis, so far as the island at large is concerned and yet, right in its centre there was a region where all the conditions prevailed which Dr. Newton has described to us as being eminently favourable to the development of tuberculosis.

In Germany, in the vicinity where I was brought up, there is a village located in a region where similar insanitary conditions prevail, and in consequence, phthisis has been quite common there.

Ventilation is another very important factor. People who live in poorly ventilated houses, lay themselves open to all kinds of microbic infection. It does not, perhaps, increase the virulence of the tubercle bacillus, but it decreases the power of resistance of the individual, and renders the tissues more susceptible to the inroads of the bacilli. I think it is important that these facts should be brought out clearly at this meeting, and hope they may perhaps have some influence upon our various municipal authorities, and induce them to try to get rid of insanitary tenement houses. By the erection of sanatoria for the treatment of consumptives much good can be done, but this disease cannot be stamped out so long as badly ventilated and insanitary tenement houses are permitted to remain as centres of infection in New York and other large cities throughout the country.

Dr. N. S. Davis, jun. (Chicago): I was glad to hear Dr. Newton emphasise the fact that unhygienic surroundings play such an important part in transmitting tuberculosis from individual to individual. It has been my fortune—either good or bad—to have recently come in contact with a number of families who were possessed with an undue fear of tuberculosis. In several instances this fear was so pronounced that the consumptive was almost neglected by his friends and family. While there is unquestionably some danger in close contact with the tuberculous, yet under reasonably hygienic surroundings the danger is not very great, as statistics on this subject have shown.

There is no question but that the acquirement of tuberculosis is most favoured by first, a lack of good house ventilation, and second, a lack of exercise, which causes imperfect lung ventilation. The importance of unhygienic surroundings as a factor in the causation of tuberculosis cannot be over-estimated, but we must not overlook the fact that there is also an inherited inclination to the disease.

Dr. Charles L. Minor (Asheville, N.C.): While I have nothing to say against the tubercle bacillus as the causative factor of pulmonary tuber-

culosis, I am glad that Dr. Newton has laid so much stress upon the hygienic side of this question. The "tuberculophobia" raging throughout the land at present has no doubt its utility, but it has grown very extensively without a corresponding growth in prophylactic measures, which in this country have been so much neglected. In the neighbourhood of Asheville I can show you damp, insanitary houses which are occupied by negroes who, despite the climatic advantages, become rapidly infected with tuberculosis as a result of the atrocious hygiene of their hovels; but the upper classes are in one sense equally careless in regard to that most important of all hygienic factors, ventilation. The American public is under-ærated, and it is not getting frightened in the right way. The tubercle bacillus is practically ubiquitous, and, as the doctor said, the whole world would long ago have become tuberculous if it depended solely on the germ. We are not conducting our crusade against tuberculosis properly. We should instruct people how to live *before* they get sick, and not wait to interfere until they have acquired tuberculosis.

Dr. E. R. BALDWIN (Saranac Lake, N.Y.): Dr. Newton's paper is very interesting as showing the influence of moisture upon the tubercle bacilli. Ransom, of England, who has made some investigations in this connection, claims to have demonstrated that the bacilli grow upon wall paper where the surroundings of the house are very damp. Whether these experiments have been confirmed or not I am unable to say. It is well known that dampness will preserve the vitality of the bacilli for a long time in the expectoration, and it is quite conceivable that the cases cited by Dr. Newton were attributable to the longevity of the germs in those surroundings. From a purely bacteriological standpoint it seems interesting to review these cases in that connection.

The influence of dampness as a causative factor of tuberculosis has not particularly impressed itself upon us in the Adirondacks. Some of the houses there are located upon damp soil, although most of the soil in that region is dry and sandy. We know that the bacillus loses its vitality quite rapidly by simply drying it.

Dr. JUDSON DALAND (Philadelphia): I was much interested in the remarks made by Dr. Newton. In his paper he referred to Iceland, where the meteorological conditions would apparently favour the spread of tuberculosis. There they have much dampness nine months in the year, with high winds and an absence of light. In spite of these unhygienic conditions the island remained practically free from tuberculosis until fifteen or twenty years ago, when a few cases of the disease were introduced from Denmark. Subsequently the cases rapidly multiplied, and three years ago 134 cases of tuberculosis were reported in that sparsely settled island, the inhabitants of which number about 70,000.

Dr. E. O. OTIS (Boston): I wish to call the attention of the Association to the most valuable work which is being done in certain cities, especially New York and Boston, in connection with tenement house reform. This is a most important step in the prophylaxis of tuberculosis, and each one of us should do what we can to advance this all-important work in our own cities.

Dr. NEWTON (closing the discussion): The remarks made by Dr. Baldwin, who discussed my paper from a bacteriological standpoint, go to show that when we are living over a damp cellar we are living over a culture medium. When I was serving as Post-Surgeon at Fort Cummings, New Mexico, the soil was so dry in that region that it was difficult, if not impossible, to sink a well deep enough to reach water. The ground was like baked potter's clay.

Nearly the entire command lived in tents. These tents had board floors raised a few inches from the surface. And when, in the course of time, the floor of our kitchen tent was pulled up, the ground underneath was found to be quite damp, and had probably been so for months. It had been rendered moist by the water which had filtered through the kitchen floor, and it might have proved a first-class culture medium for the propagation of the tubercle bacilli or other germs.

This circumstance made quite an impression on my mind at the time, and certainly points to a possible source of illness, which might easily escape observation in permanent camps.

THE DEGENERATIVE RESULTS OF DEFICIENT VENTILATION.

BY CHAS. DENISON, M.D.
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THE idea that a known (?) disease like tuberculosis springs from the evolution or rather dissolution of the forces which have to do with our being, that it is an evidence of the *variation* of the law of *harmony to environment*, a retrograde movement towards dissolution and death; this idea, I say, of a basic law of degeneracy, which finds its chief expression in this wasting disease, is too profound to be easily grasped, too adverse to our set habits of thought to be easily accepted. Therefore, if I fail to convince the hearer in a necessarily curtailed presentation of proof, let me suggest that he simply suspend judgment till the opportunity happily occurs for him to study John Fiske's "Outlines of Cosmic Philosophy," especially the interesting chapters on "Matter, Motion, and Force," "Rhythm," "Evolution and Dissolution," and the "Sources of Terrestrial Energy." Then I think he will come to the same conclusion here reached and have a clearer understanding of this matter.

There is a deeper and more fundamental source of knowledge than that which the microscope, with its wonderful delineation and detail, can supply; and the liability of being side-tracked by that instrument's findings should be recognised, that we may not fail to grasp the true origin of our degenerative diseases and their evolution.

An important fact in evolution is that, all the way up to

man, the beings evolved have had no voice, save instinct, in deciding their destiny. With the advent of man, however, there was something added to the law of the survival of the fittest, that is, a deciding brain. This higher order of life—the soul of man with its Godlike attributes — involves not only equivalent responsibility, but the possibility to mistakes, because of that responsibility. I am not a preacher to expound and lament man's moral errors, but of all his physical ills the profoundest and most far-reaching mistake which we now have to analyse is known through its results in the disease tuberculosis, the lately termed "white scourge" of the race. Let us try to free our minds from preconceived beliefs and, rising above the details of bacillary evidence, try to determine how far man himself is to blame for his miseries; then try to learn how the punishment of this scourge is as it should be in the divine order of our creation and our evolution. Thus, we may come to realise that tuberculosis springs from the mistaken adaptation of man to his environment, *i.e.*, is chiefly due to the faulty civilisation of the present time.

The instinct of the Rocky Mountain beaver teaches him to build his winter hut in conformity to his environment, and wonderfully so with regard to the severity or mildness of the approaching season. A shrewd weather prophet interprets these findings and prognosticates the future for his fellow men. Who will prognosticate the probabilities of life and death from the character of our own habitations? Are they a healthy outgrowth of man's conformity to his environment? No, it is here, as I hope to show, that the greatest nonconformity lies. The question of the suitability of man's abode and life to his highest development may, I think, be studied better through the subject of *ventilation* than in any other way.

There was a man in our town who was much annoyed by the constant dinging of a piano in an adjoining apartment of his lodging house, so he rigged up a gong run by electricity and his improvised music was made to loudly

accompany the piano till the latter stopped. If there could be an automatically acting ventilator invented, built into a window pane or into the outside walls of a room, which would sound a gong whenever ventilation was imperfect—by reason of any excess of carbonic acid or any organic impurity above an established healthy standard—and such device were used in all living rooms, there would be so much noise in every town that nothing else could be heard. The racket would probably bring relief in perfect ventilation and the readjustment of the hearing organs to suit this noisy environment would be accompanied, or rather ante-dated, by a great decrease in the degeneration which induces tuberculosis. The reward for the successful inventor of such an automatic ventilator should be great, for the good results would be almost inestimable. Of course a visual index of atmospheric purity and impurity might be substituted for a sounding alarm or gong which, when the desired limitations were reached, could be made to show them.

This would not be a more wonderful discovery than many that have been made of late—as for instance, the thermostat, or heat regulator, which automatically controls the heat of a building within one degree of a desired point—but what a salutary correction it would be of the defects of our living rooms.

Let us take an average living room, say 14 feet square and 10 feet high. Not wishing to be illiberal I have assumed this as the average size, approximately, of living rooms where one person sleeps at night or lives by day. There is, we will say, one door and two windows to each such room. Of course we can instance such a room wherein half-a-dozen sleep, and again we may know of a home where one person occupies a room of three or four times that space. It is a fair average we are after. We will say this 2,000 cubic feet space represents about the average of the hundred thousand living rooms there are in a city of that many inhabitants. It should

be noted that the total window space is one half covered with curtain, and as the sun can be shining into only one side of a house at a time, and as half the time he is usually shut out by clouds, how little of the direct sun's rays can get into this average room.

We will further describe this room as having no fireplace in it (the great majority have not), and as having the door shut nine-tenths of the time, and a window not open one-tenth of its area for one-tenth of the time.

This room has been evolved in the progress and is one of the results of our civilisation. We may admit its necessity because it is here to stay; but the evolution of its ventilation is as yet an unsolved problem to over 90 per cent. of humanity.

What, then, should be sufficient ventilation that health may not suffer for the want of it? It is not merely that the carbonic acid which is thrown off from the lungs shall be replaced by its equivalent of oxygen from the outer air. So perfect are the joints the builders make, in this day of advanced art in architecture, that a guest-room, though aired and then unused for weeks, may need ventilating again before a new occupant enters; why? because it has lost the natural qualities of the out-door air.

A man exhales 400 volumes of carbonic acid to every two to four volumes he inhales; he must then have 4,000 cubic feet of air per hour, as Parkes says, and 1,800 as Briggs determined, lest the carbonic acid in a room exceed 6 in 10,000 and 8 in 10,000 parts respectively, which they separately considered to be the limits beyond which impurity should not be allowed to go. It is estimated that two candles give off as much carbonic acid as a man, a lamp as much as two men, and an ordinary gas burner nearly as much as do six men; so in addition, these sources of impurity must be considered. Ventilation necessitates the recognition of the fact also, based upon the consumption of a pound of coal per hour, that for

heating a room, 2,072 feet of air will be required for fourteen hours in the day. A thorough knowledge of ventilation necessitates, likewise, an appreciation of the various activities of persons contained in a room; also of the extra equivalent space in a room needed to off-set the rarefaction of the air at great altitudes; also the estimating of various diseased states —as when, during fever, additional poisons are thrown off into the air—and also the determining of the chemical and organic changes taking place in laboratories and work-shops.

Though all these are important, there is still something more needed to secure perfect ventilation. That the air change in this size of room is inadequate it is not only my purpose to show, but that there are other faults about this room, even were it twice as large, which seem not to have been generally, if at all, recognised. This, I think, I can make you appreciate in asking you to consider with me *the life of the air.* We will come to see that there is a vitalising principle whose force is annulled by the imprisonment of the air through defective ventilation.

How shall we express our conception of this vitalising principle so that we may recognise its dissolution under absence of ventilation? If we only had some simpler way of giving to the sun his due credit as the source of all the heat, light and motion of life manifested on the earth than has Fiske; who says, "The difference between the tropical heat of India and the cold of the Arctic regions is simply the measure of untold millions of tiny differences in the rates of oscillation of countless atoms of atmospheric gases, determined in turn by innumerable oscillatory movements propagated *from the sun to the earth.*"[1]

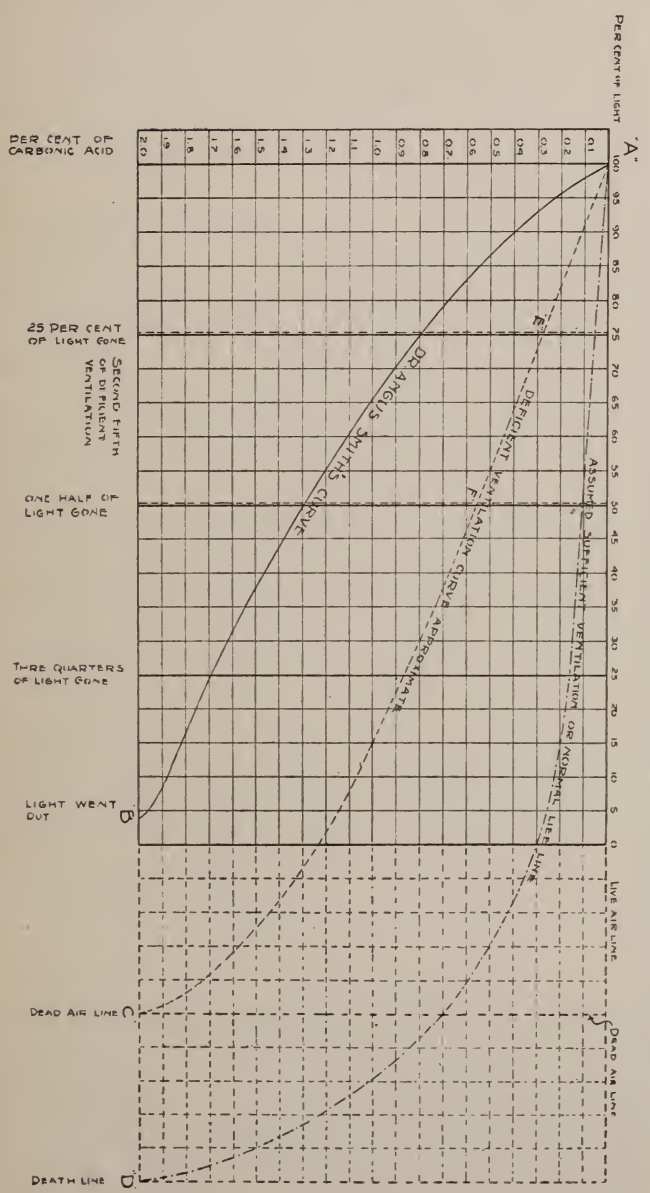
It is a simple statement, the truth of which I think all will accept, that *the life of the air exists chiefly in its motion,* which with its light, heat and electrical or magnetic power, comes

[1] "Outlines of Cosmic Philosophy."

from the sun. If the absence of this life—here denominated as *dead air*—is represented as a perpendicular line, and *live air* is represented as another straight line at right angles thereto, as is the plane of a ceiling to the sides of a room, then the gradations from live air to dead air, under the subtle influences in which we human beings live and die, can be truthfully represented as a curved line which gradually leaves the horizontal line and comes down to the perpendicular. This deficient ventilation curve is not the same, but much like Angus Smith's curved line (see illustration), indicating at stated times the measure of the light of a candle when gradually extinguished by being confined in a closed space.[2]

You can fan this receding flame into life, as you can revive a gradually extinguishing human life by opening a window, but let the previous stillness supervene and the perpendicular line of extinguishment is surely reached. It is this important fact of *the proportionate and gradual loss of light* I wish to call attention to, and by it to illustrate the proportionate loss of *vitality* in a degenerative disease. Both these losses are so gradual in the beginning they are unrecognisable. A similar curve is the line of life of the human being who is dying or to die of tuberculosis. So gradual and imperceptible to his comprehension are its graduations, he does not know where he is on the bend of the curve; but he knows quite as much about it as he does about the deficient ventilation curve, represented by the graded line from live air to dead air. We none of us appreciate our own individual positions upon this ventilation curve, as to the respective confinements of our

[2] The Table explaining this Angus Smith curve gave regular periods of time till the light went out, and the extinguishment was divided into graduations from $\frac{1}{10}$ of 1 per cent. carbonic acid, up to 2 per cent when the light went out. It took $\frac{8}{10}$ per cent. carbonic acid for the first quarter of extinguishment, $\frac{5}{10}$ per cent. for the second, $\frac{4}{10}$ for the third and $\frac{}{10}$ per cent. additional carbonic acid for the last quarter and total extinguishment.


—— DIAGRAM ILLUSTRATING VENTILATION ——
A-B DR. ANGUS SMITH'S EXTINGUISHING CANDLE LIGHT WITH INCREASING PER CENT CO_2
A-C ASSUMED DEFICIENT VENTILATION CURVE FOR COMPARISON WITH NORMAL LIFE LINE
A-D APPROXIMATE NORMAL LIFE LINE CURVE UNDER HEALTHFUL CONDITIONS OF VENTILATION.
E-F ASSUMED POSITION ON THIS CURVE WHERE HUMAN BEINGS ORDINARILY LIVE IN HOUSES
PER CENT OF LIGHT
"A"
PER CENT OF CARBONIC ACID
25 PER CENT OF LIGHT GONE
SECOND FIFTH OF DEFICIENT VENTILATION
ONE HALF OF LIGHT GONE
THRE QUARTERS OF LIGHT GONE
LIGHT WENT OUT
B
DEAD AIR LINE C
DEATH LINE D
DR. ANGUS SMITHS CURVE
DEFICIENT VENTILATION CURVE APPROXIMATE
ASSUMED DEFICIENT VENTILATION OR NORMAL LIFE LINE
E
F
LIVE AIR LINE
DEAD AIR LINE

bodies in closed spaces, and the resultant imprisonment and dwarfing of our respiratory and circulatory systems; and it becomes a pertinent question to each one of us: Shall we be exterminated by these conditions, or will the final extinguishing act be transferred to our children, handicapped as they will be by our present ignorance?

Where, on our imaginary deficient ventilation curve, is the sample room we have herein described? Do I controvert your judgments, you physicians, who have so often felt like smashing the scanty windows of the sick or sleeping chamber in order to let in some pure air, by saying that its imperfect ventilation places it in the second fifth division, that is, it is 20 to 40 per cent. along on the downward extension of the curve. Admitting this you see the whole force of my argument. It is by contrast we must judge and our sensations are only partial guides. The purest air, and therefore the livest air I know of is found when you stand on some eminence in the rays of the rising sun, with the air coming to you from off the hills or mountains beyond, sifted through pines and firs; and with your feet upon the dry but negatively electrified ground, while your head, or perhaps your whole body, is in the strongly and positively electrified atmosphere. You breathe into your uttermost air-cells this ozonised air, and your cast-off carbonic acid goes from you the instant it is exhaled. Every nerve in your body is stimulated to normal life, and your very soul is lifted up in thankfulness to God for His provision of this feast.

Turn now to a counterpart picture. The deadest air, I think I ever breathed was in the mammoth cave of Kentucky. I found there, little 12 by 6 by 8 ft. rooms, constructed of stone with one door in each, and a 16-inch square window. These had been built for the supposed good climatic effect of the *equable* temperature, always 58° F. I was told that they took sixteen consumptives down there for one month. Four died down there, one a week after coming out, and none were

benefited. In comparison with the positive effects of live air, cited above, such negative conditions, such deadness of atmosphere and ignorance of the requirements of human beings, gives the mind an ineffaceable shock and impels it to dwell upon the machinations of the devil, whose abode, except as to its traditional temperature, this cave typifies! Should a further illustration of *dead air* be needed, call to your imagination the lead chamber which Angus Smith constructed for his experiment,[1] and in which no possible interchange of air with that outside could occur. Imagine Dr. Angus Smith remaining therein, rebreathing its atmosphere as he did till candles went out, and you will have a good idea of what I mean by absolutely dead air, upon the effects of which, as described by this faithful investigator, I have not time here to dwell.[2]

Previous to this experiment, Dr. Angus Smith had thought the real evil was from organic substances in the air, but afterward he concluded that carbonic acid, even in small amounts, had an injurious influence. In this connection it is interesting to note that Lavoisier and Saguin found that the human limit of the possible rebreathing of air was when the carbonic acid had reached 10 per cent. and that "was bearable only for a short time," while Angus Smith says, "it seems to be impossible to endure 4 per cent. for any length of time."

[1] "Air and Rain."

[2] Dr. Angus Smith (in his "Air and Rain"), in describing his sensations when confined in his experimental "lead chamber," containing 170 cubit feet, says of the chemical actions going on in the body: "They may take ten years to gather impetus to make their movements strong enough to produce sensations, and disease may be generated unknown to the individual, although it may kill him in the eleventh year, but if the chemical action began at first so violently as to produce decided sensations, he might be able to avoid it at once before it produced any abiding impression." After remaining in his chamber 100 minutes he found a reduction of oxygen to 20 per cent., and "the air had an unpleasant flavour or smell," and on entering it again after a minute he found "it extremely bad." He says "it took about four hours for the lungs to recover their tone."

The life of the air consists, to a greater extent than has been heretofore recognised, in the molecular motions of its atoms caused by the sun's influence. The diffusibility of the air, the easy motions due to changes of temperature in different strata, and the fact that light as well as sound depend upon the wave motions of ether, are all forms of molecular activity which probably impart the life-giving principle to our atmosphere. This motion is always present till meddlesome man interferes. For instance, if a narrow beam of light is thrown into a closed dark room in which the air is apparently still, every particle of dust is seen to be in constant motion. From the fact that there are varying states and amounts of electricity in the different strata of the atmosphere, a conclusion is justified that finer forces govern the life of the atmosphere than merely its composition of oxygen, nitrogen, moisture and carbonic acid. Besides, let us not forget the contribution of vitality vegetation brings through its constant interchange of oxygen for carbonic acid. This, with the qualities of atmospheric electricity and molecular motion, are all *in restraint* if not wholly annihilated in our supposed poorly-ventilated room.

This restraint of molecular motion and therefore, limitation of vitality, are in direct proportion to the deficiency of ventilation. Herein, I conceive, lies the great mistake of our civilisation in relation to healthful human life. Here is to be seen the need of education that this cause of disease may be understood.

Let us try to elicit analogous evidence of vitality in the growing media of other products of nature than that of the dwellers above the surface of the earth. The ground in our latitude becomes regularly *dead earth* to vegetable growth as the cold of the fall and winter gradually annuls its vitality, but the warm penetrating rays of the sun in spring and summer as regularly again transform it into *live earth*, for the wonderful fructification of plant and animal growth.

Plants, too, have their life-curve, which depends upon the vivifying and transmitted influence of the sun's rays. Shut out that influence and that life-curve becomes immediately abbreviated.

Again let us consider the fish class, a medium creation depending upon air and water for its atmosphere and food. They constitute its life-giving agency and cannot be greatly changed without its extinction. How wonderful is the effect of the fish's environment upon its life-curve and upon its distinguishing characteristics, as shown by the eyeless inhabitants of dark caves, and the big-eyed sun fish of the open pond, the sluggish succor of the mud creek, and the lively grayling of the rapids.

The liveliest water I have ever seen was when, within view of a snowbank in the Rocky Mountains, a cold, dashing, mountain stream lashed itself, by its perpetual motion over the rocks and stones, into a fit abode for that king of fishes, the mountain trout; that creature full of ozone and vim, which life elements he transmits even to the fisherman who joyously captures him.

Note the difference in the life quality of that trout and of another one of the same species pulled sluggishly up from 100 feet below the surface of a still lake. The higher the order of evolution, *i.e.*, the more delicate and special the development of the nervous structure, the more susceptible to, and influenced by, the changes in environment are all created beings.

Applying this principle to the human family, we see that a limit of civilisation can be reached where delicate or small changes of environment may dissolute as well as evolute; where *extinction*, even from *lack* of conformity, may take the place of *evolution*, *because* of conformity to our environment.

There are two sides to every question! We may argue against the cramped chest and round shoulders of the bicycle rider; but the bicycle is doing a world of good in getting

people out of doors, in addition to the improved æration of the blood which results from its use.

We admit the "visiting the iniquities of the fathers upon the children unto the third and fourth generation," meaning in these days syphilis and like hereditary evils; but this law of transmission likewise works itself out to the extinction of the users of defective and deficient ventilation.

We discuss the inhalation of irritant powders and poisonous gases occurring in certain hazardous occupations, but defective ventilation, considered in conjunction *with* such causes of disease, increases their injurious effects many fold.

We may reason, as with few exceptions everybody does, that the bacillus of tubercle being the constant accompaniment of the decaying process in tuberculosis, is consequently the *cause* and source of all this evil; but the very lateness of its appearance shows it to be rather a *result* than the cause. Its absence in so many forms of scrofula, adenoid growths, wastings and catarrhs, surely eventuating in mature tuberculosis, show that the pre-tubercular and perhaps the first stage of tuberculosis, is already established presumably, in advance of the germ. These conditions are proved by the tuberculin test to be a part of the real disease before the microscope or any other ocular demonstration of the bacillus is possible. The Widal test for typhoid fever now joins the tuberculin test in showing a dyscrasia to exist, which we know is the presence of latent tuberculosis. This occurs before any ocular evidence is possible of the mature germ.

The destructive influence of sunlight upon the bacillus of tubercle is now generally admitted.[1] If, in addition, the contention of Fränkel[2] that it is a *facultative anærobic* germ is sustained, then the claim of a predisposing cause in defec-

[1] Koch: "International Medical Congress," Berlin, 1890.

[2] Sternberg's "Manual of Bacteriology."

tive ventilation is strengthened by the favourable conditions furnished for such *germination* in the unventilated lung.

We thus go back of the tubercle bacillus germ to conditions which are bound under favouring circumstances to eventuate in it; and the following important statement is warranted, which controverts the trend of scientific thought of this decade as to the prevention of tuberculosis, namely, if all of Koch's bacilli of tubercle on this earth were instantly destroyed, in due time, *the same conditions remaining*, our world would again have an ample supply. It is not for me to pretend to know the exact time which would elapse, under such a supposed temporary dispensation of Providence, until the terrible intensity of the "white plague" would be again as great as at the present time. The *old times* would come back soon enough. Undoubtedly, we would some of us, even those who are now incubating the germs, live longer and be much wiser for such an experience. We would, however, surely see the wave of bacillary domination sweep back over the human race, bringing the equivalent of the present time when, as Osler says, two per cent. of the people living have the disease, and when, as seems to me, ten times as many are getting ready for it.

Let us not mistake the providence of God. Tuberculosis has come here to stay until we, the thinking masters of creation, acquire the education to understand and abolish it. It will not "down" in response to any edict against street expectoration, the disinfection of rooms occupied by dying consumptives, or even the slaughtering of tuberculous cows, however important these measures of prevention most assuredly are.

Now the drift of this reasoning is to this conclusion: That tuberculosis springs from, or is the outgrowth of, some unified cause, which will account for its existence in cattle, horses and birds, as well as in man.

I wish to refer to the excellent paper[1] presented by Dr. Chas. Cresswell to the National Live Stock Association, at their late meeting in Fort Worth, Texas. From his considerable experience as a veterinarian in Colorado, he shows that it is entirely unnecessary to use the tuberculin test with the "plains" cattle in the Rocky Mountain Region, because even those previously infected, and transferred to the plains, *there* outlive their tuberculosis, and it does not appear in the next generation. In proof he instances the surviving members and the progeny of a very badly infected herd of over-bred Shorthorns, inbred and closely housed, of which I myself was cognisant. If also you bear in mind the great mortality from phthisis in the French and English cavalry horses under close stabling, which was quickly prevented by open-air stabling;[2] if also you are acquainted with the corroborative evidence of the close domiciling of cows, the confined caging of birds, monkeys, guinea pigs and other animals, the crowding[3] of human beings in ship-holds, prisons,[4] alms-houses,[5] and places

[1] The Elimination of Tuberculosis Out in the Open," by the Author, *Journal A.M.A.*? February 3, 1900.

[2] Parkes ("Practical Hygiene") refers to the experience with horses in the French cavalry service, and says that in ten years a loss of 180 in the 1,000 per year was reduced to 68, by giving them more room in their stables, while in English cavalry service the change for the better by similar treatment was even more striking, till the annual mortality was reduced to 20 per 1,000.

[3] Parkes ("Practical Hygiene"), in noting the relation of increased mortality to density of population, adds that "its main concomitant condition is impurity of air from overcrowding," . . . . . "especially among children, whose delicate frames always give us the best test of the effect both of food and air."

[4] Dr. de Chaumont's analysis (Parkes' "Practical Hygiene") of the air in eleven barracks and hospitals showed an average excess of over 6 volumes carbonic acid per 10,000 and nearly twice that in the cells of four different prisons. Other and extreme analyses of air in rooms (in orphanage dormitories and detention places), with space per head all the way from 51 to 150 cubic feet, gave from 31 to even 73 volumes of carbonic acid to 10,000. The ratios were constantly greater the more confined were persons or animals.

[5] Carmichael found in the Dublin House of Industry (crowded with

of public detention, or the civilising and housing of savages, as of the American Indian, you then have to come to the conclusion : that either tuberculosis results from (1) a species of auto-infection from rebreathing the body's own exhalations; or (2) from the fact that the air of these confined spaces becomes a source of infection from the loss or annulment of its life-giving principle.

Thus we are brought back to our sample room, the abode of a human being, the meagre size of which, and its deficient sunlight and air circulation, afford a sufficiently marked degree of deficient ventilation to constitute it a glaring fault of our civilisation. This now seems to be the initial cause or starting point of tuberculosis, which probably kills more people than does war, together with any other one form of disease known.

The study of the remarkable diffusibility and penetrability of gases, even through glass windows and brick walls, not to mention wooden doors with the many cracks around them, gives us some hope through what is called "insensible ventilation."[6]

But the fear is that even this much of protection will be annihilated through the *perfection* (?) of carpentry. The education which the people need, even the common people and we doctors too, *must* be obtained, and the architects and builders are not exempt from this necessity.[7]

children) that "the only cause for the excessive amount of phthisis was the foul air and want of exercise."

Parkes says "the only circumstance which is common to the two classes (speaking of seamen and civilians working in confined close rooms and thus causing phthisis and lung disease) is the impure atmosphere."

Is not the subtle effect of the occurrence of hospital gangrene in closed wards, and its infrequency in tents, an indication that the closeness is to blame?

[6] In illustration, take notice of the dark lines on the plastered ceiling of a much used room. They are the interspaces between the laths where the dirty air has been sifted through.

[7] That the education needed must be mainly directed to the ventilation of closed habitations is beyond any doubt; for Angus Smith's calculations

A more thorough study of this intricate question would lead the architect, whose usefulness is too much limited by the demands of an ignorant public, to be an upbuilder of people's health as well as of their houses. It is to be hoped he will thus arrive at a more encouraging conclusion than did James A. Greenlief, C.E., in his "How Much Ventilation?" when he said "for the ordinary private house a systematic air allowance per individual is almost an absurdity, for many of them a thorough systematic plan of ventilation is unnecessary, even were it not debarred by reason of the expense inseparable from it."

Whether ventilation, suited to the size and purpose of a building, the climate and the exposure, shall be by *natural or artificial* means, whether by *propulsion* or *extraction*, and how modified by the great variety of artificial aids of heat, steam power and electricity, we have not here time to consider in

("Air and Rain") made in the cities of London, Manchester and Glasgow, showed so small a difference in the per cent. of oxygen, as well as of carbonic acid, *in the open places*, that we can conclude that it is not so much the size of the city or the number of rooms in it, as it is the character of the rooms themselves. Parkes says, "the colliers of Durham and Northumberland, where the mines are well ventilated, do not appear to suffer from an excess of lung disease, or do so in a slight degree. While as to 'metal miners' he says among them there comes to be, in advanced life, for the males, of ages from 45 to 75, five times as many deaths from pulmonary disease 'as for males, exclusive of miners, in Yorkshire.'" This latter evidence bears upon the quality of the dust in crowded places and rooms. It is organic to no small degree Tichborne (Parkes' "Practical Hygiene"), in a Dublin street, found it from 30 to 45 per cent. organic and Chalvet, in a hospital ward in Paris, found the dust to be 36 to 46 per cent. organic matter. The sickening headache which some sensitive persons experience in, or after attending a crowded theatre, is probably not wholly due to the rebreathing of excessive carbonic acid. This "crowd poison," as this air of crowded halls is sometimes called, undoubtedly contains much organic matter thrown off in the exhalations of the people there assembled. Even the moisture of these exhalations is no inconsiderable matter. Parkes averages an estimate of 211 cubic feet of air needed to maintain, in a state of vapour, the 25 to 48 ounces of water which a human being gives off in twenty-four hours' time, and he adds that when carbonic acid in the air has reached 7 in 10,000, the smell of organic matter is generally perceptible and it is "very strong" when 10 in 10,000 is reached.

detail. My object now is to emphasise the *need* of ventilation of our living and working rooms. The lack of it leads to the pale face, sallow skin, weak pulse, with cold hands and feet, and with sluggish bowels; the feeble powers of digestion, assimilation and nerve energy; all proofs of a flagging vitality. This lethargy is due to the enfeebled and poisoned blood corpuscles, and a probably auto-infection, but worse than all to the deprivation of food for the blood, *i.e.*, oxygen from the air. In addition the dead air, which marked deficiency of ventilation implies, compels in the lungs that inactivity and limited use, which in turn means the gradual clogging of out-of-the-way air-cells with the products of combustion. There, and thus in the lungs, carbonic acid poisoning and the species of auto-infection heretofore described, are most naturally located and more or less permanently established.

I will not pretend to say what the detail of a law of ventilation will be, but there should be such a law and that, too, enforced by proper legislation. That detail will be an outgrowth of the education which is essential to right legislation. In general, however, it should limit the minimum ventilation allowable in every assemblying place or habitation for human beings, and for dairy cows, horses, &c. That limitation should be adjusted to the various lives and their activities with which the law has to do. If law can protect life as it aims to do, by fire escapes, the necessity of stand-pipes, the abatement of the smoke nuisance, the ventilation of sewers, and the non-pollution of drinking water: why should not this subtler and ever present cause of degeneration and death, *defective ventilation*, even in its slighter degrees, come under its fostering care? Certainly it should. I suggest that the effort should be made to establish and maintain the equivalent of the following: To wit, for a living apartment a minimum space of 1,500 cubit feet per individual, and a minimum ventilation, or change of air, of 2,000 feet per hour per person. If this much is not otherwise afforded in all new houses, then transoms over

outside doors and windows, preferably opening inward at their tops, should be required.[8]

A course for the study of ventilation should be made a prominent feature in all advanced schools and colleges, and the Government should carry out the many investigations which will help to determine both the best means and the proper and necessary limits of ventilation. This is one of the ways in which a *National Bureau* or *Board of Health*, properly established and supported by our general Government, could prove itself one of the most useful and worthy of all the different departments which are represented by secretaries in President's Cabinet. Until such a national Board is established the Government ought to found and liberally maintain a Commission on ventilation of houses, public halls, schools, factories and mines. Properly conducted, such a Commission could do a world of good.

[8] The variation of a proper law may be needed to suit the assembling of large bodies of people in halls, churches, &c., where occupancy is limited to a short time and a less space *per capita* seems to be allowable, or again where additional air is required, as in hospitals and certain workrooms. But the building inspector, properly working with or under the Board of Health, should not only be possessed of a spirit of the law's righteousness, but he should be a man of high intelligence and force.

DISCUSSION.

Dr. Beverley Robinson (New York): I do not wish to allow such a paper to pass by without saying a few words about it. I regard it as a valuable contribution to the science of medicine. In various communities the question is now being agitated of setting aside large sums of money to be expended for the erection of sanatoria for the treatment of tuberculosis. While I fully concur with those who believe in the value of such institutions, I feel at the same time that their erection has but a very slight bearing upon the problem which we have to solve. Far more important than the establishment of any number of sanatoria for consumptives is the prevention of the disease by surrounding the people with proper hygienic conditions, the free ventilation of dwelling-houses, with plenty of sunlight, &c. Unless this is done a patient would perhaps be cured at a sanatorium

only to be brought back to live under the very conditions that caused his disease.

I believe that our good ladies who wear long skirts are indirectly responsible for the development of some cases of tuberculosis. The dust is carried by them from the street into every room in the house, to be subsequently swept out in a very violent manner.

Dr. CARROLL E. EDSON (Denver): I think the two papers which we have listened to this morning exemplify the remark made by our President in his opening address, that this Association should consider the whole problem of tuberculosis, and not a single detail, such as its pathology or the erection of sanatoria for its treatment. We should not permit the tubercle bacillus to obscure wholly other important factors which underlie tuberculosis. The present "bacilliphobia" which is extending over the land is astonishing in some respects. It has not only affected the laity, but also the medical profession. The following instance recently came under my observation. About ten years ago a young lady went to Colorado for a time, on account of a slight apical trouble from which she recovered. She returned home and remained perfectly well. She was engaged by a family as governess, and one day in the course of conversation she happened to mention that ten years previously she had gone to Colorado on account of her health. When the family physician, who stands high in the profession and is a teacher in one of our medical colleges, heard of this, he at once insisted that she be discharged, as he considered it dangerous to have the children spend much time in company with one who had "ever" had tuberculosis.

The tubercle bacillus alone, dampness alone, or lack of ventilation alone —none of these factors are sufficiently potent to cause tuberculosis.

Dr. NEWTON: Perhaps Dr. Denison does not know that his idea of free ventilation may in some instances give rise to family discord. I recently heard of an Irishman who, while living in a sanatorium was taught to keep his windows open at night. When he tried to do this upon his return home it gave rise to family quarrels, and finally his wife applied for a divorce.

Dr. W. F. R. PHILLIPS (Washington, D.C.): The reference of Dr. Denison to the "life of the air," calls to mind some experiments made by the late Sir B. W. Richardson, which, so far as I am aware, have never been repeated by any other experimenter, although apparently of the utmost significance to the problem of ventilation. Richardson placed a number of small animals in an atmosphere of pure oxygen, and observed their breathing. After a certain time they began to show symptoms of poisoning, and some of them died. The poisoning was at first attributed to the effects of the carbon dioxide of respiration. Some things, however, suggested to Richardson that possibly it was not the carbon dioxide, so he placed some other animals of the same kind in an atmosphere of pure oxygen, and took measures to remove the carbon dioxide as fast as expired. Again, however, the animals exhibited the same symptoms of poisoning and with the same results. Analysis of the oxygen showed it to be freer of carbon

dioxide than ordinary fresh air. Richardson, therefore, concluded, that oxygen breathed over and over again, although freed from all known impurities, loses its power to sustain life, and that not from the introduction of a poison, but by a negation or withdrawal of some property in the original oxygen. To such oxygen he applied the name "devitalised." (*Report Brit. Assn. Adv. Sc.*, 1860.)

In some later experiments, he found that the passage of an electric spark through this "devitalised" oxygen restored to it the property of sustaining life. (*Richardson, Preventive Medicine*, 1884, also *Trans. Lond. Med. Soc.*, 1861.)

The conclusions of Drs. Billings, Mitchell, and Bergey ("Composition of Expired Air," Washington, 1895), were to the general effect that there was no volatile poison in expired air, and that its poisonous properties were due to the diminution of oxygen, or the increase of carbon dioxide, or to a combination of the two, perhaps augmented by the concomitant rise of temperature and humidity. However, they concluded that the discomfort produced by crowded, ill-ventilated rooms was not due to the excess of carbon dioxide.

Richardson did not offer any definite hypothesis to explain what he had observed with respect to the "devitalisation of air," although he threw out the suggestion of a structural molecular alteration in the oxygen.

There is certainly nothing intrinsically improbable in such a suggestion, and perhaps when we know more of molecular physics than we do at present, we may recognise in this suggestion the foreshadowing of a new theory.

Dr. DENISON: (Closing the discussion.) The changes in the air are so gradual that they are not at once observed. This could be seen from the diagrams which I showed. These gradual changes are in harmony with the effects of deficient ventilation.

SOME PHASES OF THE TUBERCULOSIS PROBLEM IN COLORADO.

BY S. G. BONNEY, A.M., M.D.

THE present interest attached to this subject with its vital relation to pulmonary invalids as a class, and to the resident population of Colorado as well, renders it fitting and opportune to call attention to a few practical considerations concerning the *rationale* of the problem and methods of solution.

There exists in Colorado not only an appreciation of the communicability of tuberculosis and the necessity for rational preventive measures, but also unfortunately a somewhat unreasoning fear as to the dangers of direct infection, despite strict conformity to recognised precautionary steps. There has developed an increasing popular prejudice against the ordinary association with the consumptive, and a beginning sentiment against the further importation of individuals afflicted with the disease. The early feeling of apprehension among the people with reference to what appeared a somewhat mysterious but ever present danger of contagion has grown to a sense of alarm. The agitation originally conceived through scientific knowledge applied to public health, is giving birth to a somewhat ill-proportioned and ignorant crusade. There result embarrassing difficulties in the way of securing adequate accommodations for the consumptive, and much unnecessary humiliation, with lack of moral encouragement, to those entitled to every sympathetic consideration.

Have the actual exigencies of the situation been sufficient to justify, in the interests of society, the development of a

somewhat immoderate professional attitude and an intolerant popular sentiment? Is it not well to propound a deliberate inquiry from an impartial standpoint relative to their causes and justification?

My position is defined with emphasis in hearty support of the admirable efforts of the health authorities, and with contempt for the indifference of those who refuse to co-operate in the rigid enforcement of regulations tending to the restriction of the disease. I am not in sympathy, however, with an agitation not warranted by the facts and tending to create alarm. While the attraction of our climatic conditions has become a serious question for our resident population, it is apparent that the present local sentiment is but partially justified by actual conditions.

Public attention has been repeatedly drawn to statements emanating from the Health Departments relative to the increasing number of cases of pulmonary tuberculosis reported to have originated in Colorado. Unequivocal interpretations have been promulgated by some physicians to the effect that the source may be ascribed to direct contagion, and that as a logical deduction tuberculosis is likely to become an important indigenous disease in Colorado, entailing future ruinous effects upon her communities. I am unable to accept the evidence presented to substantiate the alleged increase of consumption contracted in Colorado, and submit that the data as yet introduced are altogether too meagre to warrant such conclusions.

Some years ago in presenting a paper before the Colorado State Medical Association, I protested against a popular premature verdict concerning this subject. In support of my position then taken, and I believe now to be confirmed, I will refer very briefly to portions of my previous article, with such statistical addenda as have been furnished subsequently.

"A review of the material offered as evidence to establish the large proportion of cases developed in Colorado to those

contracted elsewhere, indicates that the chief source of information is found in the records of the Denver Health Department. In the Annual Report for 1896, it is stated that the number of deaths during the past year from tuberculosis developed in Colorado 'is a little more than one-sixth of the total tubercular death rate.' It is also noted that the percentage of deaths from tuberculosis contracted in this State has been progressively increasing. In 1893 the proportion is stated to be 11¼ per cent.; in 1894, 13·7 per cent.; in 1895, 15 per cent.; in 1896, 18·4 per cent."

Later reports from the Health Department show the proportion in 1897 to be 18 per cent., and in 1898 19·7 per cent. The source of information upon which these statistics have been compiled has been the returns upon the death certificates.

"I must insist that the *percentage* of *deaths* is by no means a fair criterion of the proportion in Denver of cases said to have developed in Colorado to those contracted elsewhere. The pulmonary invalid from a distance, with hopeless prognosis, is usually advised to return to his home. Comparatively few of such cases, fortunately, are permitted to die in Denver, removed from family and friends. The proportion, then, of one to six does not properly apply, as might be inferred, to the existing cases of tuberculosis in Colorado.

It is easy to demonstrate the fallacy of the alleged rapid increase in the percentage of deaths from tuberculosis contracted here.

It is apparent that a change can be effected in a given ratio by a change in *either* of its terms. In other words, the percentage of deaths from tuberculosis developed in Colorado may be increased from year to year by reason of an increase in the number of such deaths, the total tubercular death-rate remaining unchanged. Likewise, the proportion is increased if the number developed in Colorado is constant, provided the entire death rate from tuberculosis is diminished.

"While the figures of the Health Department show the

percentage to have very rapidly increased, the actual number of cases originating in Colorado is but slightly larger for the four years, while the total number of deaths from tuberculosis is considerably less; thus of course effecting an increase in the proportion, but possessed of no further significance. Thus in 1893, the total number of deaths from tuberculosis is reported as 435, of which 49 are specified as contracted in Colorado, establishing the percentage of 11¼. The next year the total number was 377, a diminution of 58, while the number contracted in Colorado was 51, an increase of but two cases for the entire year. It is obvious at once that the increase is entirely insignificant, yet the proportion is published as being 13·7 per cent., a gain of 2½ per cent. in the deaths originating in Colorado for the year."

An analysis of the statistics for 1895 and 1896 gives practically the same results. The number of deaths in 1896 is but two more than for 1895, and but seventeen more than for 1893, in spite of an increase in that time of 26,000 in our population. Yet the percentage is much increased in 1896 on account of a diminution of sixty in the total tubercular death rate.

It is of much interest to note that the statistics for 1899 recently furnished by the Health Commissioner are decidedly at variance with those previously reported, and serve to some extent as an official refutation of the alleged rapid increase of pulmonary tuberculosis in Colorado.

Despite an increase of 50,000 in the population of Denver since 1893, the number of cases specified as having developed in 1899 is but four more than in 1893, and the percentage of such cases to the total deaths from tuberculosis is but 9·9, about one half of that reported for the three previous years, and less than any proportion which has been determined since 1893. The compilation of these statistics was based upon the same official sources of information and with the employment of the same methods, as in previous years.

The practical significance of a material annual increase in the population has not been considered in the system of computation thus far employed. Admitting the possibilities of error necessarily attending any method of determining the relations of indigenous consumption, I can suggest none more satisfactory than the proportion of such cases to the population. Accepting the figures of the Health Department relative to the population of Denver, and the number of deaths from primary tuberculosis during the past seven years, the percentage of such deaths per one thousand inhabitants is found to vary but little from year to year, the proportion being less in 1894 than in 1893; in 1896 slightly less than in 1895, and in 1899 30 per cent. as compared with 36 per cent. in 1893.

A factor of no inconsiderable importance is the strong inherited susceptibility of a portion of the younger population in Colorado. Manifestly, in view of the special predisposition, such infant cases should not be recorded as instances of deaths from indigenous tuberculosis. A great majority of these are cases of tubercular meningitis, recognised as developing largely from previously infected bronchial glands rather than from external sources.

While at first thought observations concerning tuberculosis in the native born appear particularly conclusive, it becomes apparent that they possess but little significance in support of the supposed evidences of an alarming and widespread dissemination of the disease through direct contagion. It seems proper, therefore, to emphasise the fact that of all the cases reported to have died from tuberculosis contracted in Colorado during the past seven years, nearly one fourth were in children under four or five years of age, 85 per cent. of whom died of tubercular meningitis. In 1897, out of a total of 88 cases of indigenous tuberculosis, 22 were under four years, and 19 died of tubercular meningitis.

A further consideration is the absence of proof that cases reported to have developed in Colorado were actually con-

tracted there. Much testimony has been adduced in recent years demonstrating the extraordinary frequency of unsuspected tubercular infection. Under changed conditions in subsequent life an active process supervenes as the individual resistance is lessened. In view of the large number of people who come to Colorado to remain indefinitely with invalid relatives and friends, frequently undergoing hardships and privations themselves, and thereby diminishing their resistance, is it not highly probable that some may develop an active condition from an infection previously latent? The fact that an individual exhibits physical signs of tuberculosis one or two years after arrival is no evidence that the disease was originally contracted in the State. No case should be thus recorded without recourse to a diligent investigation concerning the history. While under certain conditions, direct contagion is an accepted possibility in Colorado, as elsewhere, I submit that a reasonable interpretation of official data fails to indicate that consumption contracted there is actually increasing to any extent. If it is, it remains to be demonstrated by statistical observations not as yet introduced.

On the other hand, much clinical testimony has been presented tending to establish the relative infrequency of such cases. As far as I have been able to observe from the experience of others and my own, there has been in almost every case abundant reason for the development of the disease by virtue of marked inherited taint, the presence of some recognised predisposing cause, environment, occupation, or special exposure. In view of the foregoing considerations, I protest against dogmatic statements relative to the danger of contagion and the spread of tuberculosis in Colorado.

It must be remembered, however, that the influx of consumptives in all stages of the disease and in every condition of financial distress, constitutes an economic problem not to be ignored. The somewhat indiscriminate character of the cases sent to Colorado is not such as to appeal to popular

welcome, nor inspire sympathetic and mutually cordial relations. Unfortunately, it is the advanced case that is more frequently observed. Many come to the State as a place of last resort, having vainly sought improvement elsewhere.

A reference to my own statistics previously reported, shows 71 per cent. of all the cases to arrive with distinct evidences of tubercular infection in each lung with a total average period of delay before arrival following the development of the disease of a little over eighteen months.

A large class with no conception of their individual needs, and with mistaken ideas as to conditions found, are hurried to Colorado, impoverished financially, expecting to secure immediate employment. Many are compelled to work for a pittance in order to supply the most pressing necessities; others are doomed to disappointment even in this, and are obliged to seek assistance in order to return home, or become a charge to the State.

Serious hardship is reflected upon the resident employée and his family in being forced to compete with the cheap labour of the unfortunate consumptive in his desperate strait. The frequent spectacle of hopeless cases removed from home, family and friends, tends to inculcate public pessimism and unbelief in the possibility of ultimate arrest of the disease in general, to retard charitable impulses and interested efforts for the relief of those less seriously afflicted.

At the same time the struggle for work and the meagre compensation allotted a portion of the population, added to an exaggerated notion of the practical dangers of contagion, serves to awaken a sense of resentment, and impair to some extent natural humanitarian instincts.

It can hardly be said that the consumptive with such limited resources profits materially from the hardships unwillingly imposed upon others. Whether successful or not in securing employment, the battle for him is necessarily against great odds, and the ultimate disastrous results afford

a further commentary upon a state of affairs deplorable, and to some extent avoidable. With added care and discernment on the part of physicians elsewhere as to the character of cases referred, local conditions can be materially modified by a comprehensive system of public instruction and a conservative legislative control.

The first requisite should be compulsory notification and a properly conducted registration of all cases of tuberculosis. This does not imply isolation, personal humiliation, or interference with social or business pursuits. Quarantine for such a disease is neither desirable or practicable in the interest of either the consumptive or the general community. To be in a position to receive competent instruction from some responsible source, either directly or, when feasible, through the medium of the attending physician, entails no hardship for the consumptive, and affords added protection to himself and the public. Whatever burdens might be imposed upon the pulmonary invalid by reason of such a procedure, would result purely through public misconception as to the manner in which the infection is conveyed, and exaggerated ideas as to the everyday dangers of contagion.

For such erroneous popular impressions which have thus reacted to delay the practicability of more thorough protective measures, the medical profession is to some extent responsible, and should in turn apply the remedy, *i.e.*, the inculcation of more complete knowledge. With a capable and humane enforcement of notification and registration laws, there can be directed toward the consumptive and his family and the general public, distinctive and separate methods of instruction. The invalid, through whose active and personal co-operation alone can success be attained in the effort for public protection, can be furnished with carefully prepared circular information, explaining the dangers of infection and reinfection, and describing in detail all necessary preventive measures, with an emphatic and insistent appeal for their observance. It is

the infected individual to whom special efforts of this nature should be directed rather than to the community, which is only influenced thereby to an inflamed public sentiment without the accomplishment of practical benefits.

For general distribution, official information should be essentially of a reassuring character. The public should receive instruction from responsible sources concerning the comparatively few methods of possible infection. Full explanation should be made of the exceedingly slight danger of contagion from an intimate and prolonged association with the consumptive under certain precautions, compliance with which prevents him from becoming a source of danger to the community. It should be made clear that the disease never results from a single exposure ; that the infection is comparatively slow and incremental in character. Emphatic announcement should be made of the fact that the mere presence of the bacillus is not the sole factor in causing the spread of tuberculosis ; but that an element equally potent and necessary is the individual predisposition ; that without lessened general resistance and increased vulnerability of the tissues, the soil is not receptive to the bacillus and infection rendered unlikely.

To maintain a high degree of resistance in those already predisposed, and establish greater immunity for all, the argument should be advanced in favour of greater individual attention to mode of life, occupation and environment, including the hygiene of the home, and a degree of governmental inspection and control, with especial reference to the construction and ventilation of public buildings, churches, school houses, theatres, libraries, tenement houses, factories, commercial establishments and conveyances.

The question of legislative interference with marriage and other matters involving the liberty of the consumptive, and disturbing his relation to his family and society, should receive no mention in official public communications, as being at present both impracticable and unwarranted. A problem so

delicate can never be fairly adjusted by recourse to arbitrary legal enactments based upon the medical principles of marriage selection and social aspects of procreation. More properly is it within the province of the physician in his advisory capacity to exert such an influence as may be indicated in his own judgment, and justified by individual circumstances.

It is not too great an assumption to hope that with the adoption and intelligent elaboration of such a supervisory and educational system, there may be afforded adequate protection for the community without an abatement of kindly and humanitarian feelings toward a large afflicted class of our fellow beings.

DISCUSSION.

Dr. Otis: I would like to say that last year—which was the first year during which the Massachussetts State Sanatorium for Consumptives was in operation—64 per cent. of the incipient cases (according to Dr. Claff, one of the visiting physicians) and 30 per cent. of all cases (Dr. Bowditch) were discharged as arrested. When all the other States of the Union can do as well as this in treating their consumptives at home, I think the fears of the people of Colorado and other States can be readily allayed, for we shall no longer find it necessary to send our consumptives away.

Dr. R. H. Babcock (Chicago): The facts of this admirable paper have been so forcibly and clearly put that further remarks upon it appear unnecessary. Furthermore, I think the discussion should be left to the contingent from Colorado. Nevertheless, the facts set forth, instead of showing any danger to the people of Colorado, should be a source of satisfaction to them, because, in spite of an increase of those conditions which would naturally lead to an increase in the disease, there has been such a slight increase in the number of deaths from tuberculosis originating in the State.

As Dr. Bonney said in his paper, it is highly unjust and misleading to set forth percentages of deaths. When we hear that in 1894 there were only two deaths more than in 1893, and that the increase in the total number of deaths has been relatively in the same proportion since, fear of any special danger from this disease simply falls to the ground. The people should congratulate themselves rather that with so great an increase of tuberculosis there has been such an insignificant increase in the total number of deaths from cases originating in Colorado. Furthermore, the seeds of the disease may have been sown in those persons before they came

to Colorado, and lain dormant for long periods, or they may have lived in unfavourable environment, or perhaps they were the children of tuberculous parents. The population of Denver has greatly increased, and this has favoured an increase in the disease. Moreover, the percentage of increase of cases originating in Denver is not a fair showing for the State.

It would certainly be unjust and unkind for the medical profession of Colorado to stir up fear in the minds of the people in connection with the dangers of the spread of tuberculosis, for it is well known that many of the physicians there went there on account of their own health, and where would they be to-day were it not for the beneficial climate of Colorado?

Dr. JAMES C. WILSON (Philadelphia): I cannot allow this opportunity to pass without saying a few words in approbation of this most temperate, reasonable and timely paper. Dr. Bonney has not only pointed out the problems, but he has suggested the principles upon which they are to be solved. He has certainly done right in calling the attention of physicians in the East to the fact that by sending unsuitable cases to Colorado, or persons whose financial condition is such that they must seek work in order to support themselves upon their arrival in Colorado, they not only increase the hardships of such patients but also of the residents of that State. As Dr. Otis has just pointed out, highly efficient climatic treatment is accessible to many tuberculous patients without the necessity of taking a long journey, or the expenditure of large sums of money. It seems to me that Dr. Bonney has conferred a great boon upon the profession from this point of view, and the widespread publication of his paper ought to have great influence in staying the curious tide of feeling which has developed in the State of Colorado and in other localities which, on account of the climate, are becoming populated by tuberculous patients. The present panicky outbreaks among the people in various States in connection with tuberculosis, call to mind the choreic epidemics in Europe during the Middle Ages.

Dr. R. G. CURTIN (Philadelphia): The fact should be borne in mind that Denver is becoming a very large city, and as the population becomes more dense tuberculosis always increases. Colorado probably largely owes its reputation as a health resort to its dry climate, but in Denver the atmosphere has no doubt undergone some alteration on account of the frequent sprinkling of the streets and lawns, and the moisture deposited through escaping steam, combustion from houses and increased number of factories. All these conditions have a tendency to make a city like Denver less dry, and consequently less valuable, as a rural and dry health resort.

Dr. DENISON: When I went to Denver in 1873, the population of the city was 16,000; it is now 170,000. Our proportion of cases of consumption originating in Colorado was, in former years, about one-eighth of 1 per cent. The highest ratio we have since reached in any year, is less than 2 per cent. of the total number of deaths, excluding deaths from tuberculosis "contracted elsewhere." This is very good considering the changed conditions under which these deaths have occurred. Chief among these I consider the entailment of the disease by heredity, especially in Denver, where many of the older residents, who were once tuberculous, lived, and it is among

their children that I believe much of the increase in the number of deaths is to be found. Before I went to Colorado, I only saw one case of tuberculous meningitis ; since then I have seen nine there. The frequent occurrence of this disease is perhaps attributable to the fact that the little children very frequently crawl about on the floor, where the tuberculous sputum has found a lodgement, and in this way they become infected.

Dr. JAMES A. HART (Colorado Springs): I would like to report my experience in Colorado. Five years ago I reported that I had seen but one case of tuberculosis originating in Colorado Springs in my own private practice. Up to the present time I have no others to report.

SOME PERSONAL OBSERVATIONS ON THE EFFECT OF INTRA-PLEURAL INJECTION OF NITROGEN GAS IN TUBERCULOSIS.[1]

BY DR. H. P. LOOMIS.

NEW YORK.

DISCUSSION.

Dr. H. LONGSTREET TAYLOR (St. Paul): I have had some experience with the injection of nitrogen gas into the pleural cavity in cases of tuberculosis, and it is strange that one man's experience should differ so absolutely from another's in regard to a therapeutic measure. I have failed to see any improvement in the condition of the patient after such injections. I do not believe that the gas remains in the pleural cavity for any length of time, and it does not put the lung at rest. I have tried the method very carefully in about a dozen selected cases, and that is the result of my experience. In one or two of the cases there was a temporary improvement. I have seen the gas entirely disappear in five days, and in no case did it apparently remain longer than two weeks. In one case, where I was unable to inject the gas on account of the existence of an adhesive pleurisy, without effusion, I sent the patient down to Chicago, where they likewise failed to get it in.

Dr. SOLLY: Dr. Loomis did not give us his results. He was cut short before he had finished reading his paper.

Dr. BABCOCK: I am very much surprised and disappointed to hear Dr. Taylor's experience with this method of treatment. I have seen it used in a number of cases, and am quite familiar with Dr. Lempke's work, and although he does not claim improvement in all cases, I believe that in the majority of cases improvement does take place. I have in mind a patient who received these injections at intervals of four or five weeks for a year, and in spite of the fact that her home environment was most unsatisfactory, her symptoms were practically arrested at the end of that time. I recall another patient who consulted me with reference to the advisability of a change of climate, and I was surprised to find so few physical signs in the chest in comparison with what I expected from his own statement regarding his condition, as well as that made by his family physician a few weeks previously. The improvement was explicable to me, however, when I learned that he had received an intrapleural injection of nitrogen gas, which

[1] Paper not received in time for insertion.—ED.

was promptly followed by an increase in weight, with lessened cough and expectoration. It has seemed to me that even if this method of treatment had no other value, it at least appeared to give these patients a start upwards, so that other methods could be more satisfactorily employed.

Dr. CHARLES DENISON: To my mind, there is no doubt as to the beneficial effect of the intrapleural injection of nitrogen gas, so far as it will put the affected lung in a quiescent state, but I want to ask if this same object cannot be attained by another and less dangerous method, or at least, by a less severe method. About a year ago I read a paper before the Colorado State Medical Society, in which I described a method of strapping the chest with adhesive plasters. The strips of plaster, one from the back and one from the front of the chest, are placed over the affected side of the chest, crossing each other in the axillary region and then drawn tightly to the opposite shoulder, where they are fastened to a collar. By this simple method I believe that the affected lung can be placed entirely at rest. I have done it many times, and in my opinion it entirely does away with the necessity of intrapleural injections. The latter operation is contra-indicated when both lungs are affected and is prevented by pleuritic adhesions; while the method I have described can be used under all conditions. I have found that it is very effectual in cases of pulmonary hæmorrhage, where the source of the hæmorrhage is accurately known. It is also good in controlling the lung movement in excavation cases, and as an aid in the desired contraction or healing of cavities.

Dr. STUBBERT: The intrapleural injection of nitrogen gas can only be effectual when it produces absolute compression of the lung. I have used it in hæmorrhage cases with entire success, and my experience with this method of treatment has led me to the conclusion that the operation should always be done under X-ray illumination. Otherwise it is apt to fail, because, if the lung is not fully compressed, we have done nothing more than to further interfere with its free ventilation while allowing its continued use.

Dr. CHARLES L. MINOR: I have had under my observation several cases of pulmonary tuberculosis which had been treated by this method previous to coming under my care, with apparently decidedly beneficial effect. Some of these complained of dangerous heart symptoms at the time of the operation. I recall one case in particular where the patient gained flesh and was otherwise much benefited by the treatment. Referring to the effects of compression of a diseased lung I would cite the following case which recently came under my observation:—The patient, a girl of 21, had an old apical trouble which remained quiescent for seven years, when, as the result of great imprudences on her part, she developed tuberculosis of the left apex, which spread rapidly downwards; there were numerous crepitant râles as far down as fourth rib anteriorly, a high temperature and an unfavourable general condition. Subsequently, she developed a very active serous pleurisy on the left side, which compressed the lung tightly against the spinal column. There was absolute loss of breathing in that lung, excepting at the apex (and I doubt if any amount of

strapping would have accomplished this) and the heart was forced to the right side to such a degree that it was necessary to draw off a portion of the fluid ; but as I had read of Dr. Murphy's work in this connection, I only drew off enough to relieve the pressure on the heart. The fluid remaining in the chest was slowly absorbed in the course of six weeks, and subsequently the girl's condition improved very markedly. Her temperature, which had previously risen to 101° F. in the evening, remained about normal, she gained in weight and appetite, and the physical signs indicate that her tuberculous process has become or is becoming quiescent.

I fully agree with one of the speakers in his statement, that if the injections of nitrogen gas are made indiscriminately, we can expect only bad results, but feel that in selected cases we are justified in recommending its use.

BACTERIO-THERAPEUTICS WITH ESPECIAL REFERENCE TO TUBERCULOSIS.*

BY EDWARD R. BALDWIN, M.D.
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IN my effort to present this subject I will include for the purposes of this paper, in order to cover more broadly the use of bacteria in medication, both preventive or immunising methods and serumtherapeutics. I cannot, however, attempt more than a summary of our present knowledge of the subject in connection with human diseases other than tuberculosis.

The use of living but weakened bacteria in the prevention of the like disease has found but little scope outside of vaccination for variola and anthrax. Considerable immunity has been produced in this way experimentally against streptococcal, pneumococcal, diphtherial, and tuberculous infections, but its therapeutic employment would obviously be irrational. Living streptococcus inoculations have, however, been by accident or intent successfully employed in the treatment of sarcoma and lupus (Coley's first method).

The employment of dead bacteria, their extracts or culture-products, has at present an undoubted field in cholera, plague, and typhoid prevention in human beings. The results of Haffkine's[1] anticholera inoculations have demonstrated its protective power for a limited time, while the use of extracts of plague-baccilli gives promise of similar comparative immunity.[2] The inoculations against typhoid in the British army are encouraging in their results.[3] In other diseases

* Read at the General Session of the Congress of American Physicians and Surgeons, held at Washington, D.C., May 1, 2, 3, 1900.

there has been little encouragement except as regards the lower animals. For therapeutic use the extracts, or dead bacteria, have not commended themselves in acute diseases like typhoid, plague, sepsis, pneumonia, and diphtheria.

The use of serums or tissue-extracts of animals immunised or treated with bacterial substances for these purposes manifestly is much more applicable for therapeutics, because it brings to the aid of the infected organism the protective substances or powers of others. The striking success of diphtheria-antitoxin in treatment has caused the flood of serums for all known diseases. It will here be sufficient to remind ourselves that except tetanus-serum no others have shown brilliant results in human medicine. It is interesting to note that both these serums have pre-eminently antitoxic as distinguished from bactericidal powers. Among the serums that have claims upon our notice at present the streptococcus,[1] pneumococcus,[4] and that of recurrent fever,[5] are said to have bactericidal or bacteriolytic properties only, while the serums of plague, typhoid and cholera, may have both antitoxic and bactericidal powers. Of tuberculosis serum I will speak later.

Experiments upon animals, and to some extent upon man, are entirely satisfactory as a basis for a much wider usefulness of serums and tissue-extracts as immunising agents.

The promptly curative effects of diphtheria-antitoxin may obscure in the minds of some the good results of immunisation by its use, but its demonstrated value should encourage a much more extensive employment, especially as the improvements in preparation have lessened the dose and increased the potency. These remarks also apply with greater force to tetanus. It needs no sage to observe that at present bacteriotherapeutics and serumtherapeutics have, with the exception of diphtheria, their best field for practical use in immunisation against their respective diseases.

With this brief review of the general subject with which

I do not assume familiarity, I crave attention to some remarks with reference to tuberculosis.

While I consider it not unprofitable to mention the present clinical status of tuberculin, it is certain that it can serve no useful purpose to recount the history of the blind leading the blind of a decade ago. It remains a history for the contemplation of psychologists. The term tuberculin has been used to cover broadly all extracts and culture-products of the tubercle-bacillus, and should not be confused with serums, as is frequently done. The extracts prepared subsequent to Koch's original tuberculin that have been used clinically received various names according to their object and method of preparation, and may be enumerated as follows :—

(1) Original tuberculin (abbreviated "T. O.") ; boiled, concentrated and filtered, glycerinated cultures ; now chiefly used for diagnosis.

(2) Purified tuberculin ("T. Pur.") ; the resultant redissolved precipitate of the first with 60 per cent. alcohol.

(3) The new tuberculin ("T. R.") ; an unsterilised, unfiltered, glycerin-water semisolution of living, dried, pulverised, and washed bacilli.[6]

(4) Tuberculocidin and antiphthisin ; dilute tuberculin made from the slight residue after precipitation with sodium-bismuth iodid.[7]

(5) Hunter's[8] modifications ; similar to purified tuberculin by precipitation with ammonium sulfate.

(6) Tuberculoplasmin ; the filtered watery solution of the protoplasm of moist living baccilli, extracted by crushing with hydraulic pressure.[9]

(7) Watery extracts of bacilli without culture-medium.[10]

(8) Tuberculinic acid ; the nucleic acid obtained from fat-free bacilli, decomposed by superheated steam.[11]

It was soon discovered that the original tuberculin produced no immunity against relapses of tuberculosis, where the disease seemed completely arrested and even apparently

cured by its use. Hence the new tuberculin, containing the substance of the bacilli and not its extractive matter, was introduced by Koch because it was found in animals to confer immunity against, as well as to be curative in the sense of complete arrest of, the disease.

The results of these experiments with the new tuberculin are entitled to respect (although not yet completely published as promised) (see Beck[12]) because they show the possibility of producing at least temporary immunity in guinea-pigs. Unfortunately, the conditions are such that man cannot tolerate proportionately greater doses of this bacillus-poison; nor, if he could, would the immunity be certain to be sufficiently lasting to commend its use. The clinical results, so far as they relate to new tuberculin for preventing relapses, are disappointing, though inconclusive as yet. Moreover, from our present knowledge of its effects, the tubercle-bacillus poisons used for immunisation would require such care to avoid overdosage that grave danger of chronic poisoning and cachexia would result from attempts to keep up the immunity even in vigorous subjects.

Therefore, it appears to me that the subject of tuberculin mainly interests us at present in relation to its local action on tuberculous tissue, and to the mechanism of this specific relatively increased tolerance, observed especially as a consequence of injections of the new tuberculins, dead bacilli and those of weak virulence.[13 14] To discover, and if possible, utilise this relative protection for passive immunity in the treatment of tuberculosis is the aim of research to-day.

Much interest clings to the nature of the tuberculin-reaction, and many theories have been held concerning it. That of Koch, which assumed a direct necrotising action on tuberculous nodes; of Hertwig,[15] that ascribed it to chemotaxis; of Eber,[16] to "heightened cell-energy"; of Buchner,[17] Rosenbach,[18] and Charrin,[19] to "latent inflammation" and fever susceptibility; of Klein,[20] solely to mixed infections;

of Arlong,[19] to weakening of the tubercle, and increase of secretion by the baccilli; of Liebmann[21] and Ribbert,[22] who thought the baccilli were increased in potency, have all been abandoned or modified with further study and the discovery of analogies. The later assumption of Babes[23] and Proca that it is a process of fermentation or enzyme activity excited by tuberculin is more in line with our present knowledge.*

A long list of substances is now known to produce, like tuberculin, local and general reactions in tuberculous subjects, and similar general disturbances with fever in healthy persons when large doses are employed.

In general they are digestion-products such as albumoses and their ferments; also certain alkaloids such as physostigmin, pilocarpin, atropin; certain acids as cinnamic,[25] cantharidin, and especially nucleic acids and their combinations as found in bacterial proteids,[17] and finally abrin, ricin, and similar irritant bodies.

Their nature, taken in connection with our most recent knowledge of the chemical composition of tubercle baccilli and of bacteriolytic powers of serums, is to me highly suggestive of the ferment or enzyme-theory propounded, and to some degree experimentally supported by Babes and Proca,[23] to account for the tuberculin reaction. (See also Hahn.[9]) I may be permitted to present it with modifications to fit the times somewhat as follows :—Tuberculin and allied irritants cause leukocytosis, or at least stimulate the secretion of ferments by leukocytes and other cells, particularly those which surround the bacilli as a wall. This ferment attacks both the injected irritant and the similar poisons that have been slowly accumulating in the tubercles during the life-

* It is somewhat unfortunate that our ideas of the reactions and dosage should have been based on the use of the original tuberculin, since it is a crude mixture, including albumoses and peptones from the culture-medium which by themselves produce reaction, supplementing that produced by the bacillus extract proper.

cycle of the bacillus. The general fever-reaction now comes on because of the toxin set free, altered by or combined with the enzyme. The reactions are not produced in very recent tubercles nor earliest stage of tuberculosis because there has been no time for storage of toxin, which begins when the bacillus ceases to grow or dies, and because the organism as a whole has not developed susceptibility to this class of poisons, or power to attack them. The local and general reactions become less and less as more tubercles are exhausted of toxin, while the dose required to produce them increases because of less toxin in the tubercles, and also because of the now lessened sensitiveness of the whole organism—or—toxin immunity.

Inoculations of sterilised bacilli produce tubercles and susceptibility to tuberculin-reaction. Hence, for the purpose of this argument, both living and dead bacilli may be considered simply as chemical irritants which the defensive mechanism of the animal strives to disintegrate and excrete. The bacillus being markedly resistant, because of soluble fats and irritant nucleobodies in its substance, this effort fails in part and leukocytes and other cells hedge it in to form the tubercle. The nearest cells imbibe or slowly dissolve out the soluble toxin, or suffer death in the attempt. In either case the process of digestion or enzyme action is too slow to effect a marked local or general disturbance, unless there are present a sufficient number of tubercles of the same age, or unless tuberculin and similar exciters are used, or there are accompanying infections that cause an increase of leukocytes and more enzyme action.

This hypothesis satisfactorily accounts for many phenomena clinically and experimentally observed in tuberculosis and tuberculin action, and gathers force from the recently strengthened theory of Buchner,[26] that bactericidal and bacteriolytic or dissolving properties of serums are proteolytic enzymes secreted by various cells, but pre-eminently

by leukocytes. The agglutination of tubercle-bacilli by serums from tuberculous patients has been claimed by Arloing and Courmont,[27] and while this may not be a wholly specific property, it indicates the presence of some anti-body allied to those in bacteriolytic serums. If, then, we may assume that tuberculin acts as a spur to the functions of defence, we can easily apprehend the danger of over-stimulation and harm from too large and frequent dosage, or when used on patients with poor nutrition or already over-poisoned by their malady. Likewise the severe local reactions, particularly in the lung, could cause new foci by washing out the bacilli. While this may have occurred during the tuberculin craze, I believe that all trustworthy advocates of tuberculin-therapy to-day, after years of observation, think that no recognisable danger exists when the violent reactions are avoided and proper cases are selected.

Whether or not tuberculins of any sort should be favoured for limited therapeutic employment in the light of our present knowledge, I will not presume to decide, but that they can favourably influence a pure, localised pulmonary tuberculosis, and lupus, in a well-nourished and afebrile patient, seems to me sufficiently proved by clinical experience coupled with animal experiments. Obviously their use should be confined to institutions, and the patients observed through a series of years.

The experience of Petruschy[28] is valuable in showing the necessity for repeated injections of tuberculin with long interruptions, in order to attain an absence of reaction-susceptibility to test-doses. This he regards (and to my mind with some reason) as a criterion of the complete cicatrisation of all the tubercles (though not of the death of all bacilli in them). How far such a criterion may hold good depends upon how much an acquired toxin-immunity from the previous injections may have to do with it, but it is safe to say that the latent tuberculosis in a person in apparent good health,

that will not react to a full diagnostic dose of tuberculin, should cause no anxiety. The few patients who have stood the test of time and tuberculin after long intervals are alone those of value in a clinical estimate of the curative influence of tuberculin in the sense above mentioned (complete cicatrisation of foci).

It appears uncertain that tuberculins can do any more for the local process in aiding cicatrisation or absorption of tubercles than other leukocyte irritants, such as cinnamic acid[25] and nucleins ; but if a certain degree of toxin-immunity can be produced by the new tuberculins it is more rational to employ a specific irritant. Considering the difficulty and danger of producing even comparative immunity by the use of tuberculins, the question is practically resolved to this : Can we safely aid nature to advantage in her attempt to hem in and destroy the tubercle-bacillus and its products by medication that increases the hyperæmia and absorption from tuberculous nodes ? I think it is reasonable to affirm that we can within narrow limits.

The successful treatment of tuberculous joints by combined active and passive hyperæmia (Bier's[29] method), the complete absorption of tubercles from the peritoneum after simple laparotomy, due to creative hyperæmia (Hildebrandt[30]), and the same result in lupus from tuberculin, X-ray, and other methods producing inflammation, are certain indications that it is rational so far as they can be applied to pulmonary tuberculosis.[31]

A more attractive subject for consideration is serum-therapeutics in tuberculosis, which is in an experimental stage at present. A great variety of relatively immune animals and birds have been utilised in the search for an anti-tuberculous serum without practical success.

On the other hand, Maragliano[32] and de Schweinitz[14] have attained some prolongation of life in tuberculous guinea-pigs with the serum of horses injected with bacillus-toxins. The

serums have been and are being used clinically with greater or less claims for success.

Paterson[33] and Behring[34] found antitoxic properties in certain bird-serums, and de Schweinitz[14] and Behring[34] in tuberculous cows treated with toxins. These were found unsuited for use on human subjects, because of irritant properties. Maffucci and Vestea[35] obtained prolongation of life in guinea-pigs with serum of toxin-treated sheep, but as it produced fever it was thought to contain tuberculin, and its activity thus accounted for. The antitoxic properties of the serums of Maragliano and Behring were assumed to be demonstrated by the inhibition of a tuberculin reaction in a human subject, and prevention of death from a fatal dose of the toxin in healthy guinea-pigs. None have so far been proved bactericidal or immunising, and the evidence is yet unsatisfactory (see Trudeau and Baldwin[36]) as to the much-wished-for antitoxic power, which is at least so weak as to be unappreciated when measured by its immediate influence on the fever of tuberculous patients.

Thus far no tissue has been found to have an especial affinity for the bacillus-toxin as in tetanus and diphtheria. This may be the reason that we have such slight evidence of the presence of a strictly antitoxin body.

It might be expected from what has been learned about the mechanism of the tuberculin-reaction that a bacteriolytic property might be obtained in serums or tissue-extracts of immunised animals. If present, the practical value of such a serum might be limited by its inability to get at the bacillus in the caseating tubercles, unless, like laparotomy in tuberculous peritonitis, it could cause their complete absorption. The whole subject is being studied earnestly for more light on these problems, and we may not lose hope for results of practical value.

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SUBSEQUENT HISTORIES OF PATIENTS APPARENTLY CURED UNDER ADMINISTRATION OF ANTI-TUBERCLE SERUM AS AN AUXILIARY TO THE CLIMATIC TREATMENT.

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At our annual meeting in 1898 I had the honour of presenting to you a paper, entitled, "Some Statistics upon Sero-Therapy in Tuberculosis." There were reported to you in the conclusion of that paper thirty-six incipient cases, which under anti-tubercle serum treatment showed 39 per cent. apparently cured. Fifty-five per cent. were generally improved, as evidenced by decrease in tubercle bacilli, expectoration, and cough ; increase of weight, strength, appetite, and more or less improvement in physical signs of disease. Of this 55 per cent., 9 per cent. may fairly be declared arrested cases.

There were also reported forty-two moderately advanced cases treated in like manner, of which bacilli were decreased in 30 per cent., weight gained in 61 per cent., and in between 71 per cent. and 85 per cent. a marked improvement of all other symptoms was shown. One apparent cure was noted in this class.

Four far advanced cases were reported, showing general improvement of physical signs, appetite, cough and expectoration in 25 per cent., and increase of weight in 50 per cent. No decrease of bacilli or apparent cures were noted among this class.

Summarising the three classes of cases reported, it was

shown that eighty-two patients were treated with the following results :—

No. of cases treated	82.
Expectoration decreased in	82 per cent.
Appetite improved in	81 ,, ,,
Weight gained in	78 ,, ,,
Physical signs improved in	78 ,, ,,
Temperature decreased in	49 ,, ,,
Bacilli disappeared in	13 ,, ,,
Bacilli decreased in	35 ,, ,,
Cough decreased in	79 ,, ,,
Apparent immunity established in ...	21 ,, ,,
General improvement in	78 ,, ,,

In closing the paper the writer said as follows: "I wish to place myself distinctly on record as not being, as yet, a thorough convert to sero-therapy in the treatment of tuberculosis; I appear before you simply as an investigator of this subject. I believe that we are investigating along the right line, that the results of serum treatment are, as a whole, more satisfactory than treatment by any one drug; but as yet we have found no specific for this dread disease."

In pursuance, therefore, of investigation and study of this subject, it has seemed to the writer that it would be of interest to the members of this Society to hear of the present condition of those patients reported two years ago, as comprising the 39 per cent. apparently cured, as well as the present condition of eleven whose histories were not included in the former paper.

There was a total of fourteen patients comprising this 39 per cent. reported. It has been possible to trace and obtain accurate histories of only nine, but in addition to these, the remaining five are known by general repute to be in the same condition as when they were discharged; we have no knowledge of any relapses. Those whose histories

have been traced, numbering nine, are divided into two classes, representing respectively those who have been discharged three and two years.

Four have been away for three years, and their histories are as follows :—

CASE 1.—On admission to the sanatorium showed signs of incipient tubercular involvement down to the second interspace anteriorly, and to the spine of scapula posteriorly, on the right side. The examination of the sputum showed numerous tubercle bacilli with mixed infection. Serum was administered for six weeks in Liberty, then the patient returned to New York City and the injections of serum were continued for five months longer. Shortly after returning to his old environment, the tubercle bacilli had disappeared, the patient gained seven pounds in weight, and was apparently cured. During three winters he has been constantly at work. His present condition is excellent ; there is neither cough nor expectoration, and the physical signs in his lungs are negative. The patient has lost four pounds since returning to work, leaving a net gain of three pounds.

CASE 2.—Entered the sanatorium suffering from incipient tuberculosis ; no tubercle bacilli were present in the sputum. Serum was administered for three months. Patient gained fifteen pounds in weight, and was apparently cured when she returned to her old environment, where she has been at work for three years. Present condition is excellent ; there is neither cough or expectoration, physical signs in her lungs are negative, and the patient has gained ten pounds since returning to work.

CASE 3.—Entered the sanatorium with incipient tubercular involvement at both apices ; numerous tubercle bacilli were present in the sputum. Serum was admininstered for four months at the sanatorium, and for one month after the patient returned to New York City. The tubercle bacilli disappeared after four weeks' treatment, the patient gained forty

pounds, and was apparently cured when discharged from the sanatorium. This patient has been at work for three years. She had an attack of gripe last summer. At present she is anæmic, has neither cough nor expectoration, the physical signs in the lungs are the same as at the time of discharge, slight dulness at right apex. There has been a loss of twenty of the forty pounds gained here, her weight now being normal.

CASE 4.—Entered the sanatorium with incipient tubercular involvement of the right upper lobe. The examination of the sputum showed a few tubercle bacilli with mixed infection. Serum was administered for two months and a half. The patient gained ten pounds in weight, the tubercle bacilli disappeared, and she was apparently cured when discharged from the sanatorium. This patient has been at home for eighteen months, and her present condition is excellent; the physical signs in the lungs are negative, and there is neither cough or expectoration.

Five patients have been away for two years, and their histories are as follows:—

CASE 1.—Entered the sanatorium with incipient tubercular involvement of both upper lobes, and a moderate number of tubercle bacilli present in the sputum. Serum was administered for six months. Tubercle bacilli had disappeared, the patient had gained five pounds, and was apparently cured when discharged from the sanatorium. She worked in New York City for fifteen months, and then returned for the purpose of entering the Nurses' Training School at the sanatorium. Her present condition is excellent; the physical signs are negative; weight is stationary; cough and expectoration, due to chronic bronchitis, are still present. The tubercular process in this case was engrafted upon a bronchitis of many years' duration.

CASE 2.—Entered the sanatorium with incipient tubercular

involvement of the right upper lobe; a moderate number of tubercle bacilli and mixed infection were demonstrated in the sputum. Serum was administered for six months. Tubercle bacilli disappeared, the patient gained eight pounds in weight, and was apparently cured when discharged two years ago. This patient also entered the Nurses' Training School at the sanatorium immediately after she was discharged. She has spent four months in New York City, in hospitals, training as a nurse, with long irregular hours, and of course in a comparatively unhealthy atmosphere. Her present condition is excellent; physical signs in the lungs are negative; there is neither cough or expectoration, and her weight is stationary.

CASE 3.—Entered the sanatorium with incipient tubercular involvement of both upper lobes; no tubercle bacilli could be found in the sputum. Serum was administered for one month. Patient gained five pounds in weight. He has lived in his old environment for twenty-one months; his present condition is excellent; physical signs in the lungs are negative; there is neither cough or expectoration; the patient has gained nine pounds since returning home.

CASE 4.—Entered the sanatorium with incipient involvement of right apex; tubercle bacilli were demonstrated in the sputum. Serum was administered for three months and a-half. Tubercle bacilli disappeared, the patient gained nine pounds in weight, and was apparently cured when discharged from the sanatorium. He returned to his old environment, but engaged in out-door instead of in-door work. His present condition is excellent; signs in the lungs are negative; he has neither cough or expectoration, and has gained seven pounds since returning to work.

CASE 5.—Entered the sanatorium with incipient tuberculosis; tubercle bacilli were present. Serum was administered for seven months at the sanatorium, and continued for six weeks after the patient's return home. Tubercle bacilli had disappeared, and the patient was apparently cured when dis-

charged from the sanatorium. This patient has lived at her home for twenty-two months ; she had an attack of the grippe last winter ; her present condition is good ; the physical signs in her lungs are the same as on discharge, slight consolidation at left apex, there is neither expectoration or cough, and the patient has gained two pounds since returning home.

In addition to the five patients above reported, as being away from the sanatorium for two years, I wish to report an apparently cured case from among the moderately advanced class.

CASE A (6).—Entered the sanatorium suffering from tuberculosis, in the moderately advanced stage, at both apices ; a moderate number of tubercle bacilli were demonstrated. This patient showed also tubercular involvement of the throat, evidenced by infiltration of the interarytenoid space, and a tubercular ulcer in the trachea. Serum was administered for five months at the sanatorium, and for a short time after her return to New York. The larynx and trachea received local treatment, which did not differ in any respect from that employed in New York City. Tubercle bacilli disappeared, the trachea and larynx resumed their normal conditions, the patient gained ten pounds in weight, and was apparently cured when discharged from the sanatorium. This patient has spent two winters in New York City, going away for the summer months ; she has had one attack of the grippe and one of pneumonia since returning home. Her present condition is good, physical examination of the lungs shows a fibroid condition at one apex, and a slight amount of bronchitis ; expectoration and cough are slight. Weight remains about stationary ; tubercle bacilli have never been found in the sputum, although specimens have been frequently examined, since the patient left the sanatorium.

In addition to these apparently cured cases of two and three years ago, I wish to report those who have been discharged for a year or less, and who have spent at least one winter in their old environment. Six were treated in the sanatorium, and seven in private practice, making a total of thirteen patients. Of these thirteen the subsequent histories of nine have been traced definitely, and are as follows :—

CASE 1.—Entered the sanatorium with incipient tubercular involvement of the right apex; no tubercle bacilli were present. Serum was administered for five months. The patient gained seven pounds in weight, and was apparently cured when discharged. He spent last winter in his old environment; his present condition is good; there are signs of slight fibrosis at the right apex, but no cough or expectoration. Patient has gained two pounds since returning home; he has been away from the sanatorium for nine months, two of which have been spent in travel.

CASE 2.—Very incipient tubercular involvement, with tubercle bacilli present in sputum when admitted to the sanatorium. Serum was administered for nine months. The bacilli disappeared, the patient gained nineteen pounds in weight, and was apparently cured when discharged. She has lived in her old environment and been at work for about seven months. Her present condition is excellent; the physical signs in the lungs are negative; there is neither cough or expectoration, and her weight remains stationary.

CASE 3.—Infiltration at right apex; tubercle bacilli moderate in number. Serum was administered for four months, the dose being ♏ 40. No re-action. Bacilli disappeared, the patient gained twenty-one pounds in weight, and was apparently cured when returning to old environment, where she remained from October last to February of the present year, when she returned to Liberty. Her present condition is excellent; fibrosis established at the right apex; slight cough and expectoration still present, but without tubercle bacilli; weight is now stationary.

CASE 4.—Infiltration at right apex, at the base of the left lung, and at the left upper lobe; tubercle bacilli few in number. Serum was administered for two-and-a-half months, the dose being ♏ 45. No re-action. Tubercle bacilli disappeared, the patient gained eighteen pounds in weight, and was apparently cured when he returned to his old environment and work, where he spent one winter and summer. Last winter he spent in the south, where he went on business. He has been away from Liberty for fifteen months. His present condition is excellent; physical signs in the lungs are negative; there is neither cough or expectoration present, and the weight remains stationary.

CASE 5.—At the beginning of treatment there was infiltration at the right apex, and tubercle bacilli, moderate in number, were found in the sputum. Serum was administered for three months, the dose increased to ♏ 50 q. d. No re-action. Tubercle bacilli disappeared, the patient gained fifteen pounds in weight, and was apparently cured when he returned to his old environment, where he has been for eleven months. His present condition is excellent, the only physical sign remaining is slightly jerky respiration; there is neither cough or expectoration, and his weight remains stationary.

CASE 6.—The first examination revealed infiltration at the left apex, and consolidation of the right upper lobe; tubercle bacilli were not present. Serum was administered for four months in Liberty, the dose being ♏ 30. No reaction. The patient gained two pounds in weight, and was apparently cured when returning to his old environment, where he has been for six months, and where he still receives one injection of serum a week. His present condition is good; there is left only slight muffling of the respiratory murmur; there is neither cough or expectoration, and the weight remains stationary.

CASE 7.—There was slight infiltration at the right apex; no tubercle bacilli were demonstrated. Serum was

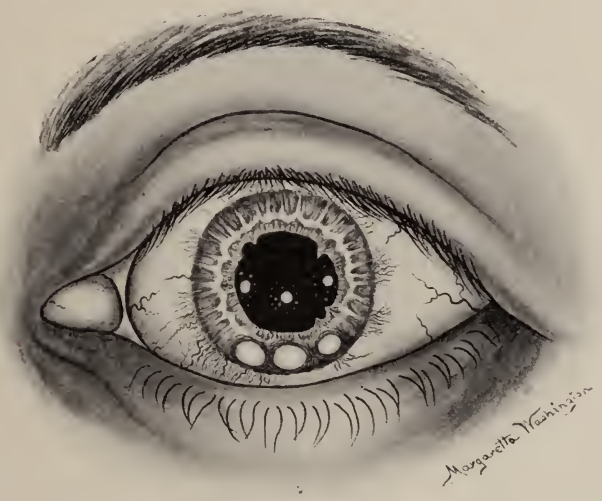
administered for four months in Liberty, the dose being ♏ 15, —one reaction accompanied by a rash. The patient gained sixteen pounds in weight, and was apparently cured when she returned to her old environment, where the serum was administered for one month, and where she remained for three months and then returned to Liberty to spend the months of March and April. Her present condition is excellent. Auscultation reveals signs of scar at the right apex posteriorly; there is neither cough or expectoration, and the patient continues to gain in weight.

CASE 8.—Showed infiltration at the right apex, but no tubercle bacilli were found. Serum was administered for five months, the dose being ♏ 25—one reaction occurred. The patient gained seven pounds in weight, and was apparently cured at the time of leaving Liberty. Her present condition is good; physical signs in the lungs are negative; there is neither cough or expectoration, and she has gained six pounds since returning to old environment.

CASE 9.—(Special). This patient I have introduced here, not because she is, as yet, apparently cured, but on account of an interesting ocular complication. Before coming under my care this patient developed tubercular kerato-iritis, evidenced by three foci of infection as shown by the accompanying diagram, kindly loaned to me by Dr. E. S. Thomson, of New York City. This patient was sent to me for the purpose of determining whether there was a tubercular condition present in the lungs which might be considered as the primary focus.

Dr. Thomson's history of the case is as follows: "On June 1, 1899, the patient noticed that the left eye was failing in vision and getting a little red and watery. She consulted several oculists, and finally came to the clinic at the Manhattan Eye and Ear Hospital. She was treated with atropine and hot-water applications, locally, and mercury followed by iodide of potassium internally for two months,

at the end of which time there was no improvement either in acuity of vision or in the inflammatory symptoms. She then came under the writer's care, and a diagnosis of tubercular kerato-iritis was made. There were at the time several grayish infiltrates in the substance of the cornea and three grayish nodules springing from the iris near the infiltration angle below. These nodules were perfectly characteristic in



appearance of tubercle. The multiple character excluded sarcoma. The two months' treatment with antispecifics, which was entirely without effect, was a strong argument against condyloma, as will be appreciated by those who have seen condyloma of the iris disappear in two or three days under mercury, as it commonly does. Condyloma commonly appears at the pupillary margin, is surrounded by dilated blood-vessels, and causes a violent reaction in the affected eye. In the case cited the nodules were grayish and cheesy looking, and the whole process was a sub-acute indolent one. Vision was $\frac{4}{200}$.

On account of the local condition, her lungs were examined by Dr. Stubbert, and she was sent to Liberty and placed under treatment, August 25. On October 5 she came to the city for a few days. The only local treatment she had had was atropine and hot-water applications. Her general health had improved; there was less ciliary redness, and the nodules had come forward from the substance of the iris and were lying partly in the anterior chamber against the cornea. Vision was $\frac{20}{200}$. Dr. Roosa was consulted and confirmed the diagnosis, and advised calomel locally.

During the next seven months she came to the city about every six weeks and stayed five or six days at a time, and had calomel dusted into the eye once a day. There was a gradual improvement during all this time. One nodule had entirely gone by December 14. The others were gradually separated from the iris, and all that now remain, June 1, 1900, are two thin cicatrices on the posterior surface of the cornea near the filtration angle. There are numerous new blood-vessels coursing through the cornea on all sides of these cicatrices. All of the corneal nodules have cleared up, leaving slight opacities, except one which seems still to have a little acute infiltration around it. The eye is perfectly white and free from inflammation. The pupil is still dilated, and the vision is $\frac{20}{100}$. There has never been any pain, and what slight photophobia there was has entirely passed away. The improvement in her eye has gone hand in hand with the improvement in her general condition, and it goes without saying that the former must be largely due to the latter. The local treatment was only antiseptic and soothing. It was very noticeable that the eye showed unfavourable symptoms whenever her general health failed a little. Each time there would be an increase of the redness and the cornea would become more cloudy. As she recovered her normal tone the eye would again quiet down. While the eye cannot as yet be regarded as completely cured, it seems not too much to say

that the process has been arrested and will probably continue to clear up. In addition to the history cited by Dr. Thomson, I found the patient's lung condition as follows: slight consolidation of the right upper lobe; no tubercle bacilli in the sputum. Serum has been administered for seven months, the dose being 25 ♏, and the patient is still under treatment. There occurred one reaction, accompanied by a rash and rheumatic symptoms. Before beginning the administration of serum, this patient had been in the Schwangunk Mountains, near Liberty, without improving; on the contrary, the condition of her eye had been growing progressively worse. This patient's general condition is very much improved; she has gained 6¾ lbs. in weight; the physical signs in her lungs are as follows: slight infiltration to second interspace anteriorly, and to the spine of the scapula posteriorly on the right side. She has neither cough nor expectoration, and continues to gain in weight.

As a study of the possibility of keeping under control an active process which, we would have every reason to believe, without treatment, in old environment, would advance progressively, I wish to quote three arrested cases as follows:

CASE 1.—Entered the sanatorium with slight consolidation of the right upper lobe. When discharged she showed a fibrosis surrounding a small cavity from which, at long intervals, is discharged a small amount of secretion containing tubercle bacilli. During the intervals between expectoration there is no cough. The patient holds her own in weight, general condition, and physical signs, and has returned to her old environment and work.

CASE 2.—Left the sanatorium in an improved condition, but with tubercle bacilli present in his sputum, which have disappeared since the patient returned to his old environment, and while engaged in unhealthy employment.

CASE 3.—Had a small number of tubercle bacilli in his sputum when he left the sanatorium, but these subsequently

disappeared while the patient was living in his old environment, and engaged in his former work.

These three cases, when they left the sanatorium, were, barring the presence of tubercle bacilli, arrested cases, as far as physical signs and general condition were concerned.

Résumé.

We know positively that of those discharged apparently cured, three years ago, 11 per cent. have remained so; two years ago, 14 per cent. have remained so; 69 per cent. have remained so of those who have spent at least one winter in their old environment.

Conclusions.

The reports of cases of tuberculosis treated with anti-tubercle serum under unfavourable climatic conditions are comparatively meagre, but as far as they go the results seem to have been unsatisfactory. Therefore, it would seem as though, instead of a hoped-for specific, we have in anti-tubercle serum simply another auxiliary to climatic, hygienic, and dietetic treatment. Its comparative greater merits as such an agent in the treatment of cases in the incipient stage seems to place it ahead of all other recognised agents in a large majority of instances. Its greater value may not be so well demonstrated in its immediate effects as in the fact that, *apparently*, there is established an immunity, the duration of which is as yet not determined, and can only be measured by years of observation.

In this connection it may be noted that among patients apparently cured while taking creosote, as an auxiliary to climatic influences, a few instances of relapse have occurred. Finally, the results of two years' further study of the subject would seem to indicate :—

(1). Further confirmation of the conclusions of the preliminary paper in 1898; (*a*) The use of serum does not tax

the functions of digestion or produce gastritis, diarrhœa, or loss of appetite; (*b*) In cases wherein bacilli have disappeared, they have been lost while the sputa were still present, whereas in creosote cases the last specimens of sputa still contain bacilli.

(2) Immunity seems to be established in apparently cured cases, capable of protecting the patient effectually in his old environment at least two or three years, and *perhaps* for a longer period.

(3) The fact that cases for treatment must be selected, even among those in the incipient stage, and that it is less effective in low altitudes and city environment, conclusively ranks anti-tubercle serum among the auxiliaries to climatic treatment of phthisis rather than as a specific.

DISCUSSION.

Dr. KLEBS: I was very much interested in this paper. The later history of patients who have been under treatment for pulmonary tuberculosis is, of course, very valuable. Dr. Stubbert, however, failed to give us a very clear idea of the stage to which the disease had progressed in the cases upon which he based his statistics. The patients are described as having "many bacilli" or "few bacilli," but the exact condition of the patient is not given. Statistics in tuberculosis, as is well known, are very deceptive, and too much reliance should not be placed upon them. We are too apt to be misled by them.

I think the title of Dr. Stubbert's paper is somewhat misleading. I think he gives too much credit to the serum and too little to the *régime* followed at the institution at Liberty with which he is identified.

Dr. QUIMBY: One remark made by Dr. Stubbert, though, doubtless, not so intended. In speaking of a nurse who was assumed to have contracted pulmonary tuberculosis in the Training School on Blackwell's Island, he inferentially declared the surroundings there to be "unfavourable," as "those with which we are all familiar."

Not long since I had occasion to investigate the subject of the prevalence of pulmonary tuberculosis among the nurses in the female Training School of the City Hospital, and from the statements of the Superintendent it became evident that the percentage of cases which have developed there is decidedly less than that for women of corresponding age engaged in almost any other occupation. While I cannot give figures, the percentage

for the nurses of the City Hospital was so small as to justify the assertion that the conditions there are decidedly not "unfavourable."

Dr. STUBBERT (closing the discussion): The cases upon which my statistics are based were all in the incipient stage, with the exception of one, which was moderately advanced. I did not speak of the value of climate in those cases, as I assumed that it was a recognised fact that all methods of treatment must at the present time be considered merely auxiliaries to climatic influences. Limited time did not give me an opportunity to read that portion of my paper which referred to the fact that, whereas we are not aware of any relapses among the cases treated with the serum, we have had relapses in cases treated by means of creosote, ichthyol, &c. We are now carrying on some experiments to ascertain whether the same effects follow the use of serum in New York City as at Liberty, but so far the results have been very unsatisfactory.

In reply to Dr. Quimby, I would say that I based my statement upon information I had received from nurses regarding the poor ventilation in wards of a certain city hospital, from personal observation, and the statement of some members of the staff at Bellevue Hospital.

THE VALUE OF THE TUBERCULIN TEST IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS.

BY J. M. ANDERS, M.D., LL D.

KNOWLEDGE of the existence of pulmonary tuberculosis at the earliest possible moment is universally held to be absolutely essential for successful treatment. Penzoldt[1] and others have properly emphasised the fact that during childhood this disease is often present in a latent form and that it manifests itself in physical signs and symptoms only after puberty. Children, thus affected with the disease, may be subject to bronchial, conjunctival, aural, or gastro-intestinal catarrh-conditions, that indicate merely impairment of the general health. This heightened susceptibility to catarrhal affections, coupled with an obvious delicacy of constitution, was long since recognised as forming a predisposition to tuberculosis.

In the adult the tuberculous process is, as a rule, of slow and insidious onset and advancement; so that the curable stage is often silently passed before the affection is recognised. Especially is this true of the cases that exhibit the rarer and more unusual modes of invasion.

In by far the majority of all cases of tuberculosis, practitioners use medicinal agencies at home, until the certain evidences of the existence of tuberculosis are obtainable, such as well-defined physical signs, and the tubercle bacilli are demonstrable in the sputum; they are too often forgetful of the fact that the tuberculous process has now commonly

[1] *The Medical News*, September 25, 1897.

progressed beyond the stage of therapeutic and climatic efficiency.

The extreme desirability of clearing the nature of latent forms and dubious cases by precise methods prior to the appearance of obvious signs and symptoms, or the finding of the specific organism of the disease, is universally conceded and the wholly unsatisfactory results obtained by the commoner methods of examination, from the standpoint of rational prophylaxis and treatment, is also appreciated by the more progressive element of the profession. The difficulties and obstacles in the paths of the earlier clinicians were great and varied. Fortunately, many of these have been removed, but there are still many questions awaiting solution. Among the substantially beneficent results of modern investigations is the tuberculin test, as a diagnostic aid in pulmonary tuberculosis. It is one of two fairly accurate newer methods of diagnosticating pulmonary tuberculosis in its incipiency, the other being by means of the Röntgen-rays. The value of the tuberculin test does not depend upon its greater reliability as compared with certain other means of diagnosis, but rather upon the fact that it permits of the recognition of the disease in its latent form as well as in the incipient stages, and oftentimes at least before its presence can be otherwise determined. This view is supported by clear and convincing statistic evidence ; and if it were properly appreciated and the method carefully applied in all suspicious cases, pulmonary tuberculosis would not so commonly go unrecognised until it is no longer curable. It is a deplorable fact that really important advances in diagnosis and treatment of disease have not received proper recognition because of a want of conscientious regard for the personal and oftimes original observation of competent investigators. On the other hand, as forcibly pointed out by Solly[1] in discussing the treatment of tuber-

[1] *International Med. Mag.*, Philadelphia, March, 1900.

culosis, the profession, while following the vagaries of fashion, exemplifies the "instability of medical opinion."

As showing the value of the tuberculin test for the early recognition of pulmonary tuberculosis and especially in cases in which all other means of diagnosticating the diseases fail, we find M. Beck,[1] who has carried out 2,508 injections, declaring that in 1,154 of the cases, tuberculosis was first detected by the diagnostic injection of tuberculin. The total number of patients that reacted was 1,525, but all instances in which a certain diagnosis of tuberculosis had been made prior to the injections, were excluded. This observer admits that his figures may be somewhat in excess of the true percentage, and further, that his results show the ratio for Berlin only, and that the patients were derived for the most part from the lower and working class of society.

In this connection I may cite three cases that were recently met in my practice : the first occurred in a lad aged 14, who had always been in delicate health. The illness for which he consulted me had commenced four weeks previously, with symptoms that were distinctly typhoidal in character, and later a positive Widal reaction was obtained. A physical examination at my first visit revealed only a phthisical thorax. After the fever had declined an injection of tuberculin (mg. ii.) gave a positive reaction. An X-ray photograph was then taken and showed slight, though decisive, haziness.

The second case was one of suspected acute tuberculosis. The diagnosis was confirmed by the tuberculin test. The necropsy was held six weeks later by Dr. MacFarland, who found miliary tuberculosis following Pott's disease, with beginning psoas abscess.[2] He found, it is interesting to note, "each tubercle surrounded by a zone of hyperæmic vessels,

[1] *Deutsch. Med. Woch.*, February 23, 1899.

[2] Tuberculin, Anti-tuberculin and Anti-tuberculin serum, *International Medical Magazine*, March, 1900.

which gave it a dark bluish-purple colour," and observed also that its centre was softened and depressed.

My third case occurred in J. H., aged 19, occupation, a labourer; he was admitted to the wards of the Medico-Chirurgical Hospital, January 2, 1900. There was no history of family tuberculous taint, and the patient had enjoyed good health until February, 1899, when he took a severe cold, following upon which he continued to cough until the onset of the illness for which he applied. December 30, while stooping to lift a heavy weight, he suddenly experienced a warm saline taste, which led to cough accompanied by the expectoration of a small amount of bright red, frothy blood. Physical examination showed nothing save a few subcrepitant râles in left scapular region. Both fluoroscopic examination of the thorax and repeated microscopic examination of the sputum gave a negative result. On the other hand, an injection of tuberculin (mg. i.) responded positively. This patient's sputum afterwards showed the presence of tubercle bacilli.

White[1] has invited attention to reports of cases of reaction in the so-called non-tuberculous. He cites certain authors (Kobler and Westphal, Leyden, Peiper, Auerbach, Post and Mabl), who have reported collectively thirty reactive cases among non-tuberculous subjects. Head[2] has also prepared a chart embracing sixty-four cases of various affections, supposedly non-tuberculous, that were injected. Of these 18 per cent. reacted. He affirms, however, from the evidence, it seemed probable that "in no one disease aside from tuberculosis, does tuberculin cause a reaction in any marked per cent., if at all." Guttstadt (quoted by Trudeau)[3] has collected figures from German clinics which indicated that a well-defined reaction occurred in 8 per cent. of apparently healthy individuals. Maragliano[4] obtained

[1] *Boston Medical and Surgical Journal*, vol. cxxxvii., No. 6.
[2] *St. Paul Medical Journal*, September, 1899.
[3] *Medical News*, May 29, 1897.
[4] *Berlin Klin. Woch.*, No. 19-20, 1896

similar results in 9 per cent. of seemingly sound persons. The question arises, however, What percentage of these non-reactive cases in seemingly healthy persons have been instances of latent and obscure tuberculosis? Again, the failure of dubious cases to react may be due to errors of administration. Thus, in my own experience a few failures would have resulted had I not increased the dose beyond the usual maximum. It is a well-established fact that a small percentage of cases of undoubted tuberculosis (especially advanced forms) have been found to be non-reactive. In such, failure is often attributable to the establishment of tolerance resulting from multiple injections. These cases therefore do not tend to prove Koch's method non-efficacious, as some have supposed. There are doubtless varying degrees of individual susceptibility to the action of tuberculin and it is likewise well-known that cases of bone and joint tuberculosis require larger quantities than other forms of the complaint. Again, as pointed out by Trudeau; "when reaction occurs in apparently healthy individuals, it should be borne in mind that autopsies made on persons dying of other diseases show some unsuspected foci to exist in from 30 to 40 per cent. of those examined. It is to be recollected that an imperfect reaction is obtainable in certain cases of sarcoma, carcinoma and in syphilis, but in such instances the possibility of the existence of tuberculosis must be recollected." On the whole, the interfering conditions may be said to be few, and if the characteristic grouping of features only (an elevation of the temperature to 101° F. inclusive) are regarded as a positive reaction, sources of error can be reduced to a minimum. Is the test sufficiently accurate for practical purposes? is a pertinent question.

There is little if any diversity of professional opinion among those who have had considerable experience with the tuberculin test as to its diagnostic value when judiciously employed. On the other hand, its diagnostic importance

is doubted principally by those who have neither used it nor examined impartially the results obtained by those who have practised Koch's method.

It is a truly regrettable fact that the use of this agent in man, even for diagnostic purposes, has been condemned by many writers who almost without exception, failed to avail themselves of the opportunity to make a practicable test. I am deeply impressed with the belief, from a limited experience only, that its more general employment with judicious care, would re-establish its superior value in properly selected incipient cases. Among other writers who are entitled to be heard and who have spoken in no uncertain tones in favour of tuberculin as a diagnostic agent in tuberculosis, are, J. T. Whitaker,[1] M. Beck,[2] E. L. Trudeau,[3] F. W. White,[4] A. C. Klebs,[5] G. G. Sears,[6] E. O. Otis,[7] Von Jaksch,[8] and others.

As before stated there is a remarkable unanimity of opinion as to its value among those who have made use of tuberculin for purposes of diagnosis, and this is the more extraordinary when the great variations in the dosage employed by the different investigators are noted (*vide infra*). The question of dosage is vitally important and from personal experience I am led to believe that still greater uniformity in the results of Koch's method would follow, if medium-sized initial doses (mgr. ii.-v.) were employed; this would obviate the disadvantages arising from the necessity of repeated injections, as is generally the case when small commencing doses (*e.g.*, mgr. ss.-i.) are used. Accurate results in most reactive cases could be expected and an increased dose, if a repetition were occasionally demanded, would be unattended by any risks for the patient.

[1] *Cincin. Lancet Clinic*, 1897, n. s. xxxix., 245-248.
[2] *Loc. cit.*
[3] *Ibid.*, May 20, 1897.
[4] *Ibid.* and *Surgical Journal.*
[5] *Boston Medical* and *Surgical Journal*, February 10, 1898.
[6] *Ibid.*, August 5, 1897.
[7] *Journal American Med. Association*, October 28, 1899.
[8] Verhandl, d. Congress, f. *Innere Med. Wiesbaden*, x., 1891.

TABLE I.

Name of Reporter	Total cases injected	No. of positive reactions	Dose employed	Preparation of tuberculin used
M. Beck[1]	2508	1525	1—10 mgrms.	Koch's tuberculin.
J. H. Neff[2] ...	20	7	1—6 mgrms.	Koch's original tuberculin.
C. F. Martin and G. D. Robins[3] ...	56	23	½—3 mgrms.	Not stated.
G. G. Sears[4] ...	10	9	Not to exceed 1 mgrm.	Not stated.
F. W. White[5] ...	123	66	1—10 mgrms.	Koch's tuberculin.
Edward O. Otis[6] ...	111	55	5—10 mgrms.	Koch's original tuberculin and Koch's tuberculin (modified).
E. L. Trudeau[7] ...	14	7	½—3 mgrms.	Koch's tuberculin (modified).
W. P. Northrup[8] ..	61	40	1—4 mgrms.	Koch's tuberculin (modified).
Senator[9]	50	50	Not stated	Not stated.
Finkler[10]	73	71	Not stated	Not stated.
Guttmann[11] ...	62	40	Not stated	Not stated.
Trendelenburg[12] ...	90	89	Not stated	Not stated.
Mosler[13]	21	17	Not stated	Not stated.
Taylor[14]	51	16	1—10 mgrms.	Not stated.
Mouton[15]	12	9	½—3 mgrms.	Not stated.
Grasset and Vedel[16]	16	10	2—5 mgrms.	Not stated.
Head[17]	47	23	10—24 mgrms.	Bureau tuberculin, 10% solution of Koch's tuberculin.
Cabot[18]	21	"In no case was the result of the test contradicted by the clinical course"	Not stated	Not stated.
Von Jaksch[19] ...	72	32	5—10 mgrms.	Koch's tuberculin.

TABLE I.—*Continued.*

Name of Reporter.	Total cases injected	No. of positive reactions	Dose employed	Preparation of tuberculin used
Maragliano[20] ..	79	14	1—3 mgrms., not over 10 mgrms.	Koch's tuberculin.
Dennison[21]	32	27	5—25 mgrms.	Koch's tuberculin.
Von Ruck[22] ...	9	7	1—10 mgrms.	Koch's tuberculin.
Maydl[23]	13	9	1—8 mgrms.	Koch's tuberculin.
Port[24]	44	21	2—10 mgrms.	Not stated.
Gaffie[25]	20	"Results very satisfactory"	$\frac{1}{20}$ mgrm.	Not stated.
Rosenbach[26] ...	11	11	1—15 mgrms.	Koch's tuberculin.
Anders	12	7	2—5 mgrms.	Koch's tuberculin (modified).

Total number of cases injected 3638
,, ,, ,, positive reactions 2185

[1] *Loc. cit.* [2] *Am. Journ. Insanity*, Jan., 1899. [3] *Brit. Med. Journ.*, Feb. 5, 1898. [4] *Loc. cit.* [5] *Loc. cit.* [6] *Loc. cit.* [7] *Loc. cit.* [8] *Med. News*, Aug. 23, 1898. [9] *Brit. Med. Journ.*, Feb. 5, 1898. [10] *Brit. Med. Journ.*, Feb. 5, 1898. [11] *Brit. Med. Journ.*, Feb. 5, 1898. [12] *Brit. Med. Journ.*, Feb. 5, 1898. [13] *Brit. Med. Journ.*, Feb. 5, 1898. [14] *Journ. of Tuberculosis* (Asheville, N.C.), Apr., 1899. [15] *Münch. Med. Wochenschr.*, No. 22, 1897. [16] *Semaine Medicale*, Feb. 26, 1896. [17] *Loc. cit.* [18] *Boston Soc. Med. Sci.*, vol. iii., No. 4. [19] *Loc. cit.* [20] *Berlin Klin. Woch.*, No. 19-20, 1896. [21] *Journ. of Tuberculosis* (Asheville, N.C.), Apr., 1899. [22] *The Times and Register*, March 14, 1891. [23] *Internat. Klin. Rundschau*, 1890, No. 50. [24] *Münch. Med. Woch.*, No. 38, 1891. [25] *Gould's Year Book*, 1897. [26] *Deutsche Med. Woch.*, No. 17, 1891.

The tables 1 and 2 have been carefully prepared to indicate the practical utility of the test and are the result of my own collective investigations. As may be seen, from a glance at Table 1, which shows the total number of cases that have been injected by tuberculin, the total number of positive reactions and the dosage and particular preparations employed by the different observers, the method is fairly accurate. It was deemed necessary, however, in order to indicate the value of this reagent, to take into consideration the character of the cases at the time of the injections.

TABLE II.

Name of Observer	Suspicious cases	Percentage of reactions	Undoubted cases	Percentage of reactions	Dose employed
M. Beck	1154	100	371	100	1—10 mgrms.
I. H. Neff	8	...	12	58·3	1—6 mgrms.
C. F. Martin and G. D. Robins	2	100	24	87·5	½—3 mgrms.
G. G. Sears	10	90	...	...	Up to 1 mgrm.
F. W. White... ..	8	100	45	100	1—10 mgrms.
Edward O. Otis[1] ...	85 (?)	62·3	7	42·8	5—10 mgrms.
E. L. Trudeau ...	14	50	...	...	½—3 mgrms.
W. P. Northrup ...	31	74·2	16	100	1—4 mgrms.
Senator	4	100	46	100	Not stated.
Grassett and Vedel ...	13	76·9	3	0	2—5 mgrms.
Von Jaksch	22	79·1	20	95	5—15 mgrms.
Maragliano	47	23	...	...	1—3 mgrms., never over 10 mgrms.
Mouton	12	75	...	...	½—3 mgrms.
Port	40	50	...	...	2—10 mgrms.
Maydl	6	83·8	1	100	1—5 mgrms.
J. Petruschky[2] ...	2	100			
Anders	12	58·3	...	...	2—5 mgrms.

Percentage of reactions in suspicious cases ... ... 71·89
,, ,, ,, ,, undoubted ,, ... 78·36

With this idea in view, appended Table No. 2 was prepared; this sets forth the figures indicating how many were doubtful and how many undoubted instances of the disease prior to the injections, with the percentage of reactions of each, respectively. It will be observed that the investigations of certain

[1] *Journ. of Tuberculosis* (Asheville, N.C.), July, 1899, and *Medical News*, July 9, 1898.
[2] *Gould's Year Book*, 1900.

clinicians embraced in Table No. 1, are not included here; this is owing to the fact that details as to many important points in their statements are wanting. The percentage of reactions in patients known to be tuberculous is so high (78 = 36 per cent.) as to leave little room for doubt concerning the reliability of the test. The failures in so-called undoubted cases, as was to be expected, occurred principally in the advanced stage of the affection for well-known reasons. It having been shown by these investigations that the tuberculin test is sufficiently accurate for practical purposes, I contend that the further use of tuberculin in undoubted cases of tuberculosis can no longer serve a valuable purpose and is ever open to slight objection, as will be pointed out hereafter, hence should be discontinued.[1]

It will be observed from an inspection of Table No. 2, that 71·81 per cent. of the suspicious cases also reacted. The percentage of these cases that subsequently developed confirmed tuberculosis, or in which the diagnosis was corroborated by necropsy, cannot be even approximately stated, but several writers who had experimented clinically with tuberculin, refer to individual cases that either came to autopsy and showed tuberculous foci, or later manifested the characteristic features of the disease. Two of my own cases, reported above, were similarly verified, one at the autopsy table, the other by the detection of tubercle bacilli in the sputum. The clinically suspicious conditions for which my own cases were injected embraced the following: one acute tuberculosis, five pulmonary tuberculosis, one joint tuberculosis, one peritonitis, two pleurisy, one tubercular meningitis, and one convalescent typhoid fever.

Is there any conclusive evidence to justify the prevalent impression that tuberculin injections aggravate or facilitate the dissemination of the disease? Virchow[2] early noted that

[1] No use was here made of statistics based on therapeutic tests of tuberculin.

[2] *Deutsche Med. Woch.*, 891, p. 131.

Koch's method occasioned collateral hyperæmia, which, by producing maceration and softening of the tubercles, might easily be the cause of the liberation of tubercle bacilli from tubercles in the progress of recovery. He also found *post-mortem* evidence to establish the correctness of his position. As the result of Virchow's published argument, based on histologic and pathologic data, tuberculin, for both diagnostic and therapeutic purposes, fell into almost universal disrepute, although, fortunately, its re-use has more recently been warmly advocated. MacFarland[1] also condemns the use of tuberculin, for the reason that the reaction depends upon the conditions described above.

On the other hand, more recent and extensive clinical testing of Koch's method in widely separated parts of the world by competent observers, often working independently, has resulted in a practically unanimous verdict, which emphasises its superior value as an aid to diagnosis of incipient cases on the one hand, and in no smaller degree its apparent harmlessness on the other. The literature confirming this position is too extensive to permit of my adducing a *résumé* here.

In not a single series of cases among the many recorded above is mention made of any bad effects. One of my own non-reactive cases developed a severe pain in the left infra-mammary region lasting about ten hours, but without any associated symptoms. Head[1] refers to a case of Addison's disease, in which a fatal termination occurred thirty-six hours after the injection of xx.-iv. mg. of tuberculin. May not this serious result have been due to the larger size of the dose? It is to be recollected that early cases to which its use should be limited, are, as a rule, sensitive to the test and massive doses are not required. It has been perfectly determined also that there is a safe range of dosage, say from ii. to v. mg., or possibly even x. mg. It was during the brief period when

[3] *Loc. cit.*

tuberculin was more generally employed for therapeutic reasons, that the great mass of evidence opposed to its use for any purpose rapidly accumulated. As there are no characteristic reactions without some local disturbance, previously described, it may be safely assumed that making allowances for differences in individual susceptibility, the more extensive the previously existing tuberculous lesions, the more massive the dose of tuberculin required and the greater the ensuing local disturbance induced thereby. For these reasons, coupled with the fact that tuberculin does not promote the healing of the diseased areas, objection may be reasonably urged against its use, even in moderately advanced cases in which the diagnosis is already assured. Acting upon this assumption, I have confined its use to the cases of suspected tuberculosis, in which no other known means of recognition were available.

In this category of cases there are no gross lesions as a rule; massive doses of tuberculin are not required, and an unfavourable local action is averted. If it were limited to this class of cases it would rarely fail in promptness or efficiency in moderate-sized doses, and being an agent that is now generally available, its value to mankind would be inestimable. I have a fixed belief that tuberculin will tend to occupy its true sphere of usefulness just in proportion as the profession will in future keep in mind two rules as a guide, to wit, moderate dosage and the limitation of its usage to suspicious (incipient) cases and those that are unrecognisable by other means. This is the principal argument of the present paper, based on the statistical inquiry recorded above and my personal experience with tuberculin, and I entertain no doubt that if these principles were enforced the re-use of tuberculin as a diagnostic agent would rapidly become general, and the results prove highly satisfactory. Finally, if the use of tuberculin as a therapeutic measure in tuberculosis were abandoned (since this rests upon a misconception of the

nature of the agent) much of the opposition to an invaluable aid in the diagnosis of latent and incipient cases would be removed.

DISCUSSION.

Dr. J. W. Brannan: I should like to ask Dr. Anders what he considers a reaction after the use of tuberculin? I began to use it about a year or so ago, and I very soon found myself embarrassed because I could not tell whether I had obtained a reaction or not. In the first half-dozen cases in which I used it there was, as a rule, a marked rise of temperature, increasing with the size of the dose, but that was all; there was no constitutional disturbance whatever. In fact, two of the patients said they felt better for the treatment. As usually described, the reaction consists of a rise of temperature and increased pulse-rate, accompanied by malaise, headache, pain in back and limbs, anorexia, sometimes nausea, and the patient feels decidedly ill. Most of the cases in which I used the test were joint cases, with a history of prolonged arthritis. I spoke to Dr. Otis regarding my experience with the tuberculin, and he said he did not consider the symptoms I had obtained as a reaction. Dr. Northrup, on the contrary, thought it was a reaction. Most of the writers on the subject refer not only to a rise of temperature, but also to a marked general disturbance, with or without local symptoms.

Dr. Quimby: My own deductions, from the original statements of Koch defining the action of tuberculin upon tubercle tissue, forced me to regard it as essentially the toxine produced by the tubercle bacillus, long before its true nature became known, and to class it therapeutically as a specialised caustic with its action limited, as stated by Koch, to living tubercle tissue. This belief, which was confirmed by my observations of the results of Leyden's methods in the Charity Hospital at Berlin, where the presence of dulness and râles, regardless of the nature of the tissue changes, was accepted as conclusive indication for the injection of an unvarying dose of 10 millegrams of tuberculin, led me, at the outset, to employ very minute doses, and to look for the evidences of its action in the lung rather than in a rise of temperature, and to consider severe febrile reaction proof that too large a dose had been given. I constantly found the signs of this local caustic effect in increase of râles and at times, respirations, without any rise of temperature beyond what had been the rule previously. Of course I recognise that such testimony is modified by the personal factor of skill in detecting the variations in pulmonary conditions.

The question as to what constitutes a reaction to tuberculin is answered best, I think, by considering the local effect in initial lung lesions, evidently produced by the tubercular infection. The reactionary effect of the many substances mentioned by Dr. H. P. Loomis in his address, as being similar to that of tuberculin, has never been shown, that I know of, to be thus

specific for tubercular tissue. Therefore this special local diagnostic sign is unique and not to be doubted. It is a higher-pitched-broncho-vesicular breathing sound—puerile in character and louder than was heard at the given spot before the test was made. This has, in one or two instances, guided me to the existence of a newly-infected spot, which had not been before detected with the stethoscope. Of course where there are no signs whatever of lung lesion, as in joint disease, the rise in temperature, even a very little rise, and the "grippy" symptoms characteristic of reaction, must be depended on. But even in these cases it is well to look for the possible existence of the local lung reaction. In several of my own cases of joint and glandular tuberculosis it has given corroborative proof of the certainty of the diagnosis.

The other point I wish to make is, that the opinion expressed, as I understood Dr. Anders, that tuberculin is without therapeutic value, should only be considered as an opinion, for he produces no evidence or proof of the reasonableness of his conclusion. On the other hand it would seem that the acknowledged and esteemed diagnostic powers of tuberculin would strengthen our hope, if not belief, that somewhere in it exists the true specific. Ever since tuberculin was discovered there have been a few conscientious workers in this field whose results have been excellent; and I have myself been pleased to note a great change of opinion among medical men during the past year, and that, indeed, favourable to the use of tuberculin as a therapeutic agent. The late symposium of the New York County Medical Society on the serum method, was an evidence of this change. As for myself, I have come to believe we do not yet half know tuberculosis, and within the half we do not know is probably the specific form of treatment by some form of tuberculin.

Dr. H. LONGSTREET TAYLOR: On theoretical grounds Dr. Anders has said that we should not use tuberculin as a therapeutic agent. I wish to protest against that, because I am thoroughly convinced that much good can be done by the judicious use of tuberculin in a therapeutic way.

Dr. KLEBS: As to what determines a tuberculin reaction, I think we must depend upon the temperature chiefly. The plan I usually adopt is as follows: For one week previous to the injection of tuberculin the patient's temperature is frequently taken and averaged: then, if there is a rise of 2° F. above this average after the injection, it is regarded as constituting a reaction. Of course there are variations from the rule, and in some cases a rise of less than 2° must be regarded as a reaction.

I believe that in tuberculin we have a most valuable diagnostic agent in early tuberculosis. In advanced tuberculosis it is not to be relied upon. In advanced cases there may be an absolute lack of a reaction. I have pointed out, furthermore, in a paper which I read on this subject in Boston about three years ago, that it is very difficult to compare the results of different men who have employed tuberculin, because they have worked with different preparations. There is no absolute standard, and different preparations give different reactions. It would be a step in the right direction if all the men would use the same preparation, or preparations of

uniform strength. Dr. Quimby said he used half a milligram as the initial dose. This I consider rather large. We have begun with one-tenth milligram, and then waited two or three days until the temporary immunisation has been overcome, and then repeated the injection, going as high as one or two milligrams if the previous injections proved negative. If, after the second or third injection, there was no reaction, we have concluded that the case was not one of tuberculosis.

It is no doubt known to the members of this Association that cases of syphilis react to tuberculin, and this fact should be borne in mind. This seems also true of leprosy. I have seen this in one instance, but we should not forget that leprosy is often complicated by tuberculosis.

Dr. BABCOCK: I would like to ask the last speaker whether he referred to Koch's old tuberculin, or to the modified tuberculin of Klebs, when he spoke of the initial dose of one-tenth milligram?

Dr. KLEBS: I do not know of a "Klebs tuberculin." My father did some work with tuberculin, and introduced some modification in its method of preparation, *i.e.*, concentrating the cultures in vacuo, instead of boiling on the water-bath, as done by Koch.

Dr. BRANNAN: I do not think I have made my position quite clear. My cases, as a rule, were not pulmonary cases. They were patients who were suffering from joint affections of a doubtful nature, and were, in large part, under the care of Dr. Gibney at the New York Hospital for Ruptured and Crippled, and the question arose whether the diseased joints were tuberculous or not. Others were observed in the general wards at Bellevue Hospital. Now what I should like to know is whether, in those cases in which the use of tuberculin was followed by an elevation of temperature but no local signs or general disturbance, it can be claimed that a reaction occurred. This was the question which the surgeons asked me, in order that they might decide whether or not to operate.

Dr. OTIS: My report in connection with the use of tuberculin is already published in the TRANSACTIONS of the Association for 1896. It must be remembered that most of my cases—111 in all, I think—were not cases of pulmonary tuberculosis, but cases of cervical adenitis. My experiments were undertaken with the idea of determining what proportion of these cases was tuberculous. There were also included in my list a number of cases of syphilis. In a considerable proportion of the cases of syphilis, where I made the injections, a marked reaction was obtained. There were also a number of cases of advanced pulmonary tuberculosis in which there was no reaction whatsoever.

My cases all came from an ambulatory clinic, and on that account we were unable to take the temperature frequently. I had to depend, therefore, more largely upon the subjective symptoms, and unless I obtained very marked general symptoms in addition to the rise of temperature, I would not call it a reaction. With a reaction there is general malaise and marked constitutional disturbance. Many of my patients felt much better after the depression which the tuberculin had produced, but I considered this merely the contrast between the state of the reaction and the recovery from it. I used Koch's original tuberculin. I agree with Dr. Klebs that it is a matter

of regret that we have no standard preparation, so that results could be compared.

Dr. BABCOCK: In those cases of syphilis which reacted to the tuberculin, did you suspect a latent focus of tuberculosis?

Dr. OTIS: No tubercular trouble could be detected in those cases, and none was suspected. The evidences of syphilis, on the contrary, were well marked. I assumed that the syphilis was the cause of the reaction.

Dr. BABCOCK: In that case, why should not syphilis always react to tuberculin? In such cases as do react a tubercular focus may have existed and become manifest on account of the lowered vitality of the patients.

Dr. OTIS: I do not recollect how many of my cases of syphilis reacted, and I think we need more extended experimentation along that line before we can say anything definite about it. I saw no serious results follow the use of tuberculin in any of my 111 cases. My initial dose was half a milligram of Koch's preparation, and this was increased in some cases as high as twelve milligrams. I think the dose for an adult should be somewhat larger than Dr. Klebs has stated, between two and ten milligrams.

Dr. BALDWIN: I think everyone should realise that tuberculin should be very rarely necessary in the diagnosis of either pulmonary or joint, or any other case of tuberculosis. By utilising the older methods tuberculin is rarely necessary, excepting as a last resort, and then it may be of great value in the diagnosis.

In connection with the remarks made by Dr. Brannan regarding his joint cases, I think one or two clinical histories might prove interesting. I remember one knee-joint case where a dose of three milligrams did not cause any reaction either local or general, above a slightly unpleasant sensation. After a dose of five milligrams the patient developed a temperature of 101° F. without any local signs. The case ultimately proved to be tuberculous.

I recall another tuberculous joint case which I saw resected at the Johns Hopkins Hospital. The patient was running a temperature of 101°, and one knee-joint was swollen and painful. He was given two milligrams of tuberculin, the result of which was difficult to determine on account of his symptoms previous to the injection. The house surgeon reported, however, that following the injection the patient complained of malaise and backache and that his temperature rose about one half a degree. I think in such a case these symptoms should be regarded as a reaction. Ordinarily two milligrams is a rather small dose in a joint case; such cases require larger doses than pulmonary. The question of a local reaction is to me a very small matter. It is very difficult, in the cases where you really need to use tuberculin, to find any marked local signs, and in such cases the use of a sufficiently large dose to produce râles, or other local indications of reaction, is to be deprecated, even were it a great advantage.

Beck, in his experiments, has shown that about one-half the cases of syphilis in which he used the injections reacted to tuberculin—no greater proportion than that in the non-syphilitics. The danger of making these injections is very slight, if any, in cases of tuberculosis so obscure as to require it. There is much yet to learn as to its limitations.

THE CONSTRUCTION AND MANAGEMENT OF SMALL COTTAGE SANATORIA FOR CONSUMPTIVES.

BY ARNOLD C. KLEBS, M.D.

With plans by James Gamble Rogers, Architect.

CHICAGO.

It is not the purpose of this paper to discuss the value of sanatorium treatment for consumptives. The members of this Association are thoroughly familiar with the subject, and although there might be still a difference of opinion as to the extent of success which can be attained in different cases, no one familiar with the subject doubts the importance of the movement in this direction. Experience certainly has demonstrated the advantage of the systematic sanatorium treatment over the "open treatment" at home or in health resorts. It has further shown to a very great extent, that equally good and even better results can be obtained at home in sanatoria, than in far away regions with more desirable climatic conditions, without them; and it seems that the good results obtained in home climates outrange in duration those of foreign regions.

It will never be possible to accommodate all consumptives in hospitals or sanatoria, nor even an adequate number of those recognised as such by medical men. Therefore it will be one of the chief purposes of sanatorium treatment, not only to attract numerous patients under one roof, but also, and still more, to scatter institutions in the greatest possible number all over the country. Every one agrees on the great

educational influence which the sanatorium *régime* has on the individual, who, later, becomes a missionary in the cause of hygiene by example and by teaching, spreading broadcast the principles to which he owes his recovery, or at least a decided improvement. There certainly is no better and more impressive teacher than experience.

The fight against this disease, which is of such distinct danger to the economy of the State, is now carried on in different communities of this country; but there is need, it seems to me, of more concerted action of a national character, and with an underlying, carefully-studied plan which would bring about more lasting results. A small country like Norway has been able by such a plan to keep in check leprosy, which in many respects resembles tuberculosis. The public but little understands the extent of this danger. A great deal is done now to educate public opinion on this point, and it is to be expected that more progress in this direction will be made when professional men in general take the leadership and desert their somewhat apathetic and indifferent position. In recent years societies have been formed for the prevention of tuberculosis, the Pennsylvania Society in the lead. Splendid work has been done to educate public opinion and to influence Legislature. To their work it is largely due that the construction of State Sanatoria for the poor has been brought into consideration. But their influence is more or less a local one, although the example once set stimulates imitation to a great degree. The chief aim of these local bodies is officially to spread correct information on the prevention of the disease by distributing pamphlets and directions to the public, by organising public lectures, &c.; but unless their endeavour is backed by a strong influential and central organisation they can do comparatively little. So, for instance, a "Society for the Prevention of Tuberculosis" was founded in Chicago, and soon after its organisation, and over its head, a "Citizen's

Committee" was formed, which collected money for a Consumptives' Hospital and, if I am well informed, with good success. Probably much money will be spent for this hospital, but I believe that the plan to build it arises more from the desire to hospitalise consumptives who are not accepted in other hospitals, than to go a step forward and carry on a systematic plan for treatment. We have another hospital for consumptives near Chicago, in Dunning, built by Cook County two years ago and managed together with the insane asylum. This institution, from some reason or other, is dreaded by every one who expects to be sent there. It is considered worse than an insane asylum, or any other general hospital, and any one sent there gives up hope of ever returning. Such institutions tend very much to discredit the efforts of the sanatorium movement, and although it is certain that their erection was undertaken with the highest motives, their value could have been considerably enhanced if, in their construction, a distinct plan approved by an influential national body could have been followed.

I am well aware that in the construction and management of such hospitals or sanatoria, local conditions must be taken into account, but the experience of the past years in this direction has established general principles which, with slight modifications, can be carried out anywhere.

Since Brehmer, in 1854, started his sanatorium in Görbersdorf, numerous institutions on a similar plan have been constructed everywhere, but chiefly in Germany. In England, hospitalisation of consumptives dates even further back, but only recently have institutions been built there with a plan different from general hospitals and paying special attention to those features which materially increase their value. In this country, although we possess a few model institutions, the Adirondacks Cottage Sanatorium, under Dr. Trudeau's supervision; Dr. Bowditch's Sharon Sanatorium, the Loomis Sanatorium in New York State, and another one in Aiken, S.C.,

these constitute about the only institutions where a distinct plan is followed both in construction and management. A new era has opened in this country with the building of the Massachusetts State Hospital for Consumptives in Rutland, in October, 1898; and the first annual report by Dr. Bowditch demonstrates the beginning as a most successful and promising one. Other States are planning similar institutions, and it is to be hoped that the experiences so far gained will be most effectively utilised in the future.

The chief advantages which a hospital or sanatorium has to offer to a tuberculous patient are: The *greatest possible amount of fresh, pure and mostly open air; wholesome and abundant alimentation; protection from reinfection; cheerful surroundings and energetic guidance in regard to the daily régime, adapted to the individual case.* With intention I omit the carrying out of *other therapeutic methods of medicinal treatment*, because, although they may form the basis of important results and therefore should be further investigated, *they must take a secondary position in the treatment of pulmonary tuberculosis.* These advantages are to be found in those model institutions in this country of which I spoke before, and I should desire to add one point, which I believe has not received much attention and still is of some importance. Sanatorium life, which under any circumstances has to be a prolonged one, becomes more or less monotonous to the patient according to his or her individual disposition. We frequently see that this has a distinct bearing on the progress of some cases, and it seems of great importance to provide an adequate occupation, which will not be harmful in a given case. Games of various sorts, entertainments, lectures and so on, have for this reason been introduced into the sanatorium plan and most assuredly this always should be done; but I do not see why other occupations, useful to the patient after his discharge, should not be introduced as a prominent feature in the plan. Gardening, car-

pentering and other occupations of a similar nature; a regular manual training school could easily be introduced and should receive attention in the planning of a sanatorium. In those institutions whose purpose it is to receive the more advanced cases, and for which the name of "hospital" seems more adequate, in distinction from "sanatorium," for those in earlier stages or with greater chances of improvement, such provisions are necessarily impossible.

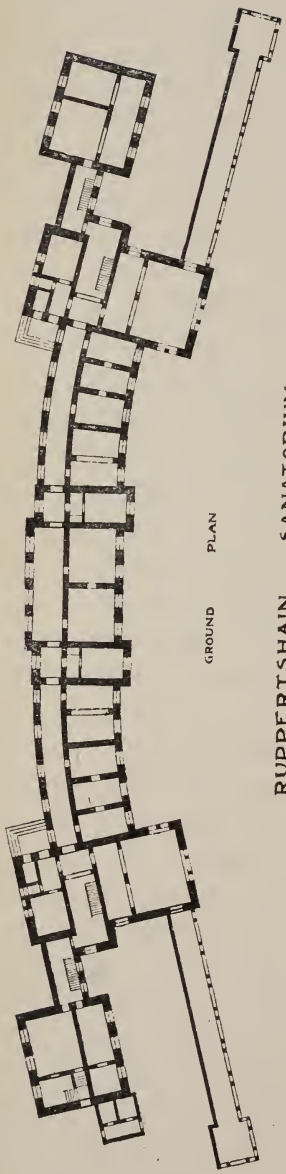
Of all the few points which I mentioned as essential desiderata for the sanatorium plan, not *one* has an absolute preponderance over the other. We have to find them united in order to succeed. But the one point which, in the constructive plan of the sanatorium as well as in the *régime* of the patients, should receive the most careful consideration, is the necessity of an *abundant pure air supply.* In every good hospital, as well as in dwelling-houses, this point receives attention, but in planning a sanatorium it must be given the benefit of the most painstaking study and carefully weighed experience. The geographical location will have to be considered, and here we encounter again the discussion on the merits of home climates as compared to foreign ones. The sending away of consumptive patients to more or less remote districts would be of small value to the community. It would not be practicable to so transport but a very insignificant fraction of them. The distinct advantage of certain climates, especially those of high altitudes and southern latitudes, over others nearer to the chief centres of population, has often been claimed but never been demonstrated conclusively. Fortunately, experience in sanatoria in districts less favoured by climate and even with distinct disadvantages, has proved the fallacy of the dogma that, "Only in the removal to certain climates the consumptive may find his salvation." Nobody even now doubts the great advantages of a life in certain regions. The dryness, and especially the purity of the atmosphere, the absence of sudden temperature changes, the

advantages of surroundings which naturally lead to an outdoor life, and many other points, speak for it. The chief disadvantage lies in the remoteness of such districts, inadequate accommodations, lack of supervision and usual absence of preventive precautions in lodging houses, with a crowding together of pulmonary invalids. The demonstration that equally or nearly as good results are possible from treatment near home must therefore be received as a great blessing. The contamination of the air in cities has hardly any influence on the districts thirty to forty miles distant. Provided the soil is well drained, there is an abundance of fresh, pure water, some hills or a forest to offer shelter against the northerly or easterly winds, and an absence of unhygienic and irreparable features, we can find a site for a sanatorium which would have all the advantages of easy access. Some locations near cities will offer still greater natural advantages. These are only the ones of greatest importance, and in the selection of a site one would naturally choose the situation which unites in itself the greatest number of natural advantages. The great natural purifiers of the atmosphere are sunshine, rain and wind. The latter two we find in abundance in our more populous districts ; the former, which has the most distinct influence on the healthfulness of a region (Ruhemann), is not so abundant, especially in winter. We can count that some of the high altitude resorts have about a three to four times greater number of sunny hours per day, but it would be incorrect to attribute to them for this reason alone an equally higher salubrity. The difference is certainly less, especially when by building our sanatorium in low lands, by well-arranged shelters and sun galleries, we succeed in getting the utmost good out of local meteorological conditions. The *supply of good wholesome food*, which together with open air forms an essential of the sanatorium treatment, can be had much easier, better and cheaper, near populated districts than in distant regions. It is a frequent occurrence

that patients sent to Colorado, Arizona, California, &c., find besides very poor accommodation, food thoroughly unfit for the sick, often inadequate for the well. This is a serious drawback to such places, as a combination of favourable circumstances in the selection of a resort for consumptives is most necessary. The excellent markets which our cities offer are open to such sanatoria in their neighbourhood, and allow not only a selection of the best quality, but also a variety of diet most desirable and important.

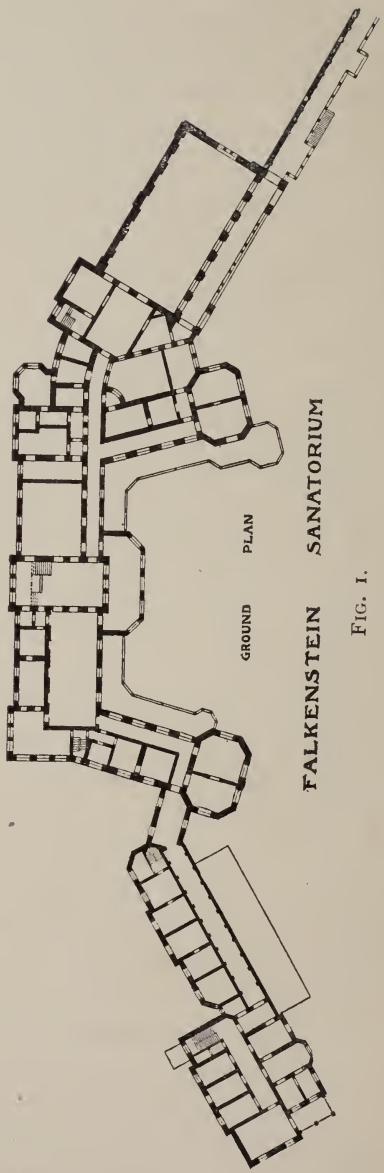
The method by which, in the construction of modern sanatoria, the unfavourable influence of local changes in weather on the patients can be successfully avoided, has received attention only comparatively recently. Falkenstein, in the Taunus, built in 1876, is the first institution which was constructed on a plan hence adopted by other sanatoria with more or less important modifications. Dettweiler, the originator of the "Liegekur" in the open air, was responsible for this first attempt, which since has proved so eminently successful. Falkenstein is the type for one of the two extreme groups in sanatorium construction, the single-building-plan, the other being the cottage plan (fig. 1.).

Here we find a large building accommodating up to 200 patients, with a south-eastern frontage, protected towards the north and west by hills and forests. From the central part of the building two wings issue at obtuse angles, forming in this way a large space well protected from northerly winds. Here we find the porches and verandahs for the rest treatment, which is carried out in the open, both in winter and summer. In later years, to increase the size of the institution, two cottages were built and joined with the main building by covered corridors. The same plan in general we find adopted at the Hohenhonneff Sanatorium (fig. 2.) except for the absence of the cottages connected with the main building and the more open angle at which the wings diverge from the central part. In the Ruppertshain Sanatorium (fig. 3.) which is



RUPPERTSHAIN SANATORIUM GROUND PLAN

FIG. 3.



FALKENSTEIN SANATORIUM GROUND PLAN

FIG. 1.

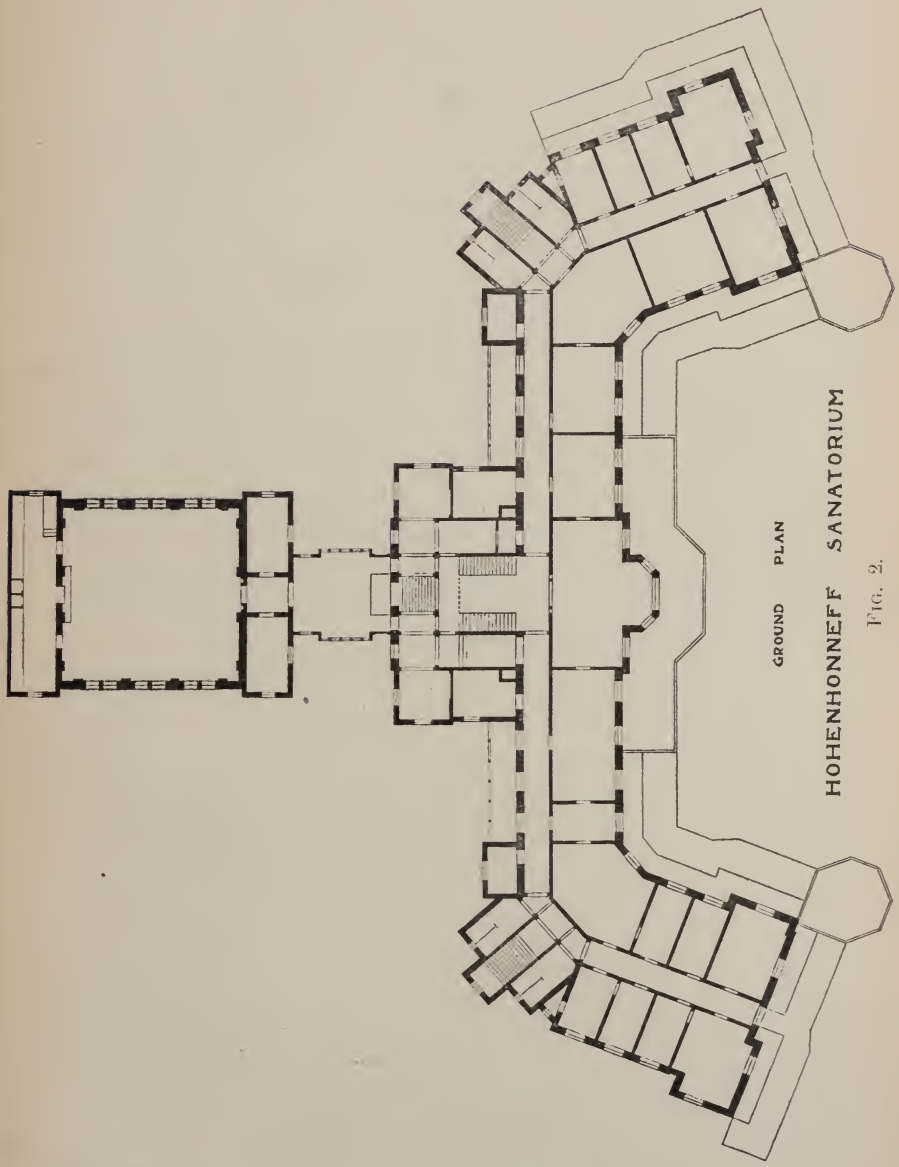


FIG. 2.

situated near Falkenstein and under the same management, we find a somewhat different plan, different chiefly in the distribution of the verandahs, and as I believe, creating an improvement over the other plan. The whole building is slightly curved, with its concavity facing south. All the rooms and wards are on this side, and the fresh air galleries not enclosed by the main building, but extending east and west, following the direction of the curve of the building.

A similar building plan has recently been adopted by the Sanatorium "Friedrichsheim" in Marzell (Kanderthal, Württemberg), near Badenweiler.

In the cottage plan, the porches of the single cottages constitute the fresh air galleries, the common rooms, as dining hall and administration rooms, being in a separate building. The little village is usually built so as to be protected from winds by a hill or by woods. The air space of the cottage rooms is increased by large transoms opening into a central sitting room. This building type is so well represented in this country, especially by the Adirondack Cottage Sanatorium, that I need not go into further details in describing it.

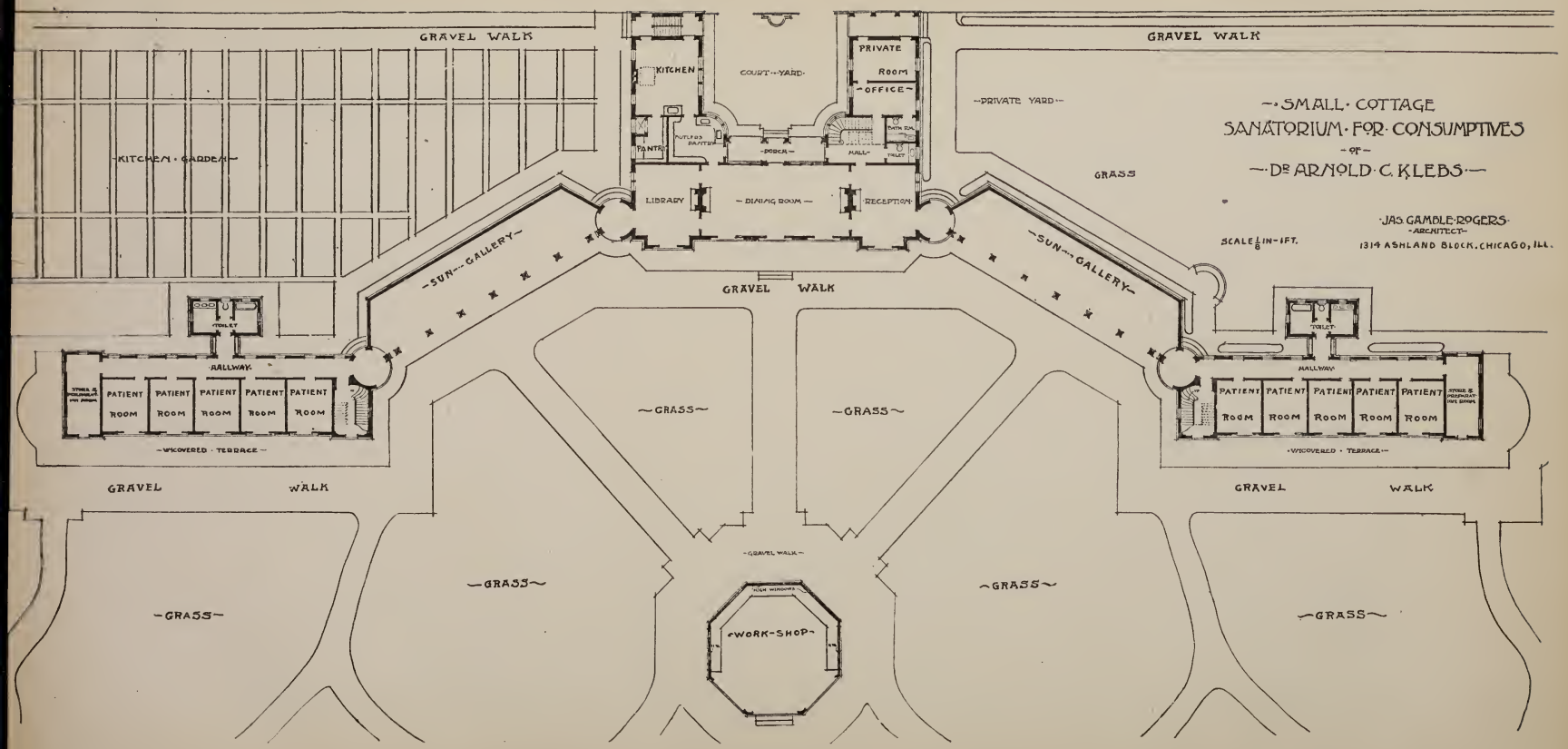
A compromise between these two constructive types was attempted in the Massachusetts State Hospital for Consumptives in Rutland. The trustees, with the purpose in mind to furnish the wards with an abundance of light, and the possibility of natural ventilation, and to avoid the ventilation from one story into the next one, common in high buildings, adopted a one-story plan of nine separate pavilions, joined on their northern end by short covered corridors. The pavilions are not arranged parallel to each other, but are radiating in different directions from south-east to south-west. There are no covered porches, except at the southern end of the pavilions, where solaria, partly open, partly enclosed by glass, are joined directly to the wards.

Shelter, together with abundant ventilation, both in the rooms and outside, are the guiding features in all these

building plans, although the purpose is achieved in different ways. All have one point in common, they can accommodate a large number of patients, from 100 to 200 and more. The single building plan allows the accommodation of a greater number of patients on a relatively small ground space, and simplifies the supervision of the patients, as well as the administration. In the cottage plan a strict supervision cannot be carried out and a larger area is required for the building ground.

As rest in the open air so largely enters the *régime* of almost every patient for at least part of the day, the question of providing sufficiently sheltered places needs the greatest attention, and furthermore, such shelters, especially in our climate of two distinct seasons, have to be adjustable to the weather during winter as well as summer. In visiting the different sanatoria, I was struck by the fact that but little attention was paid to this point. The fresh air galleries, though in winter fully meriting this term, become hot-beds in summer, no refreshing breeze being apt to reach them. Of course in most of these sanatoria other, more open galleries, are built in different locations on the grounds for use in summer; but where economy of space is essential, as in institutions for the poor, adequate arrangements should be included in the building plan. While superintending a sanatorium I have often studied over the problem as to how to meet this important requirement, and owing to the able assistance of J. Gamble Rogers, Esq., architect, of Chicago, have been able to present you the plans for such an institution, which, as I believe, unites the advantages of the institutions mentioned with others apparently lacking there. In laying out the plan for such a sanatorium, I have limited its capacity to twenty-five patients; although in adhering to the same principle of construction, a larger capacity can easily be obtained. In limiting the capacity to this number I was guided by experience, which taught me that it is almost an

impossibility for *one* man to manage a much greater number of patients, and for the ultimate success of an institution of this kind it seems of the greatest importance that the management be carried out in uniform manner. I felt most gratified to hear Professor Bouchard most emphatically sustain me in this point. If Dettweiler was, and as I hope, still is, able to personally know and supervise almost 200 patients, this does not speak against my proposition ; it only proves the marvellous ability of this master in the treatment of tuberculosis. The ability and personality of the man called to direct a sanatorium will, to a very great extent, determine its success, but there are limits to his capacity and to overstep them is usually to bring about serious consequences. The question if a large or small sanatorium is preferable, will often be determined by the expense, and here it is of course evident that the *per capita* cost will be materially reduced in a large institution. Still, we have to bear in mind what we want to accomplish, and this is not the housing of the greatest possible number of consumptives, which for many reasons is limited, but rather the creation of centres for the practical hygienic education of patients, for their own benefit as well as that of the community. The seed planted in different localities will finally spread over a wider space and bear fruit to more people than the large harvest earned at a single point. Wonderful success has been obtained as the result of the cottage hospital movement in the United Kingdom, since its originator, Albert Napper, of Cranleigh, in 1859, so ably pleaded its cause. For the accommodation and isolation of the hopelessly advanced, we need large hospitals, but the ideal for the early cases is a smaller sanatorium. In the construction of such sanatoria much can be done to lower the *per capita* expense. In my plan I have given special attention to lowering the initial cost, and as I shall try to demonstrate, I also believe that the running of such an establishment can be done at a comparatively small expense without necessarily interfering with the thorough execution of its purposes.


GRAVEL WALK
GRAVEL WALK
KITCHEN
COURT-YARD
PRIVATE ROOM
OFFICE
PRIVATE YARD
KITCHEN GARDEN
PANTRY
OUTLOOK PANTRY
PORCH
HALL
BATH RM.
TOILET
LIBRARY
DINING ROOM
RECEPTION
GRASS
SMALL COTTAGE SANATORIUM FOR CONSUMPTIVES
OF
DR ARNOLD C. KLEBS
SCALE 1/8 IN = 1 FT.
JAS. GAMBLE ROGERS
ARCHITECT
1314 ASHLAND BLOCK, CHICAGO, ILL.
SUN GALLERY
SUN GALLERY
GRAVEL WALK
TOILET
TOILET
HALLWAY
HALLWAY
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
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PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
COVERED TERRACE
COVERED TERRACE
GRAVEL WALK
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HIGH WINDOWS
WORK-SHOP

FIG. 4.

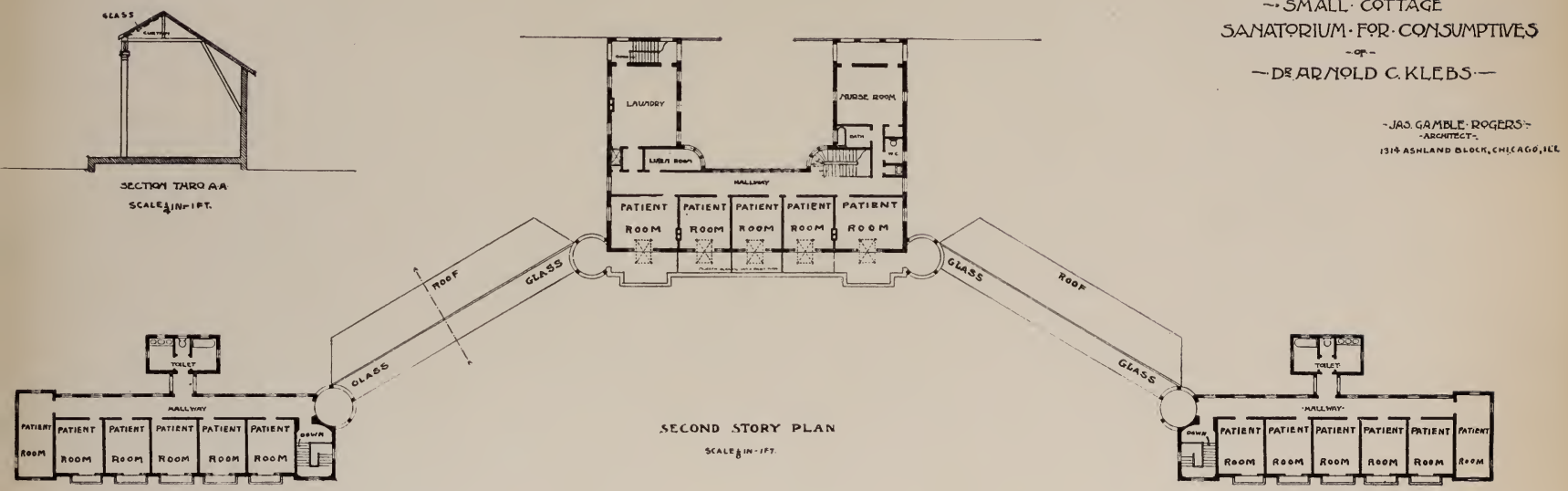
SMALL COTTAGE
SANATORIUM FOR CONSUMPTIVES
OF
DR. ARNOLD C. KLEBS
JAS. GAMBLE ROGERS
ARCHITECT
1314 ASHLAND BLOCK, CHICAGO, ILL.
GLASS
CURTAIN
SECTION THRO. A.A.
SCALE 1/4 IN = 1 FT.
LAUNDRY
NURSE ROOM
BATH
W.C.
LINEN ROOM
HALLWAY
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
ROOF
GLASS
GLASS
ROOF
GLASS
GLASS
TOILET
HALLWAY
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
DOWN
SECOND STORY PLAN
SCALE 1/8 IN = 1 FT.
TOILET
HALLWAY
DOWN
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM
PATIENT ROOM

FIG. 5.

My plan (figs. 4 and 5) embraces three cottages, joined by two galleries. The main building contains two offices, bedrooms of superintendent or head nurse, and in the second floor five bedrooms for patients who have to be kept in bed, with a balcony so arranged as to allow the beds to be wheeled out in the open air. The annex to this building, extending backward and to the north, has a cellar for storing coal, wood, &c., and heating rooms, laundry, kitchen, pantry and servants' rooms on the second floor. The galleries which join the cottages to the central building diverge from the latter at an obtuse angle and are entirely open to the south, but enclosed toward the northern exposure. This enclosure can be removed entirely in summer, and in the months which are neither hot nor cold ample ventilation can be obtained by removing the lateral parts of the enclosure. The roof of the gallery is so arranged as to allow the sun rays to reach its deepest part ; still if too hot, the extreme end of the roof can be easily lowered and so exclude the sun. This same arrangement serves also for protection of the gallery during rainy weather, and being made of glass, does not exclude the light, except when the shades are drawn. The gallery is sufficiently wide to offer a complete, though thoroughly ventilated shelter in any weather, and is chiefly intended for the carrying out of the rest in the open air, and also serves as a covered way for communication with the two cottages, which contain in two storeys twenty single rooms for the accommodation of patients. In the arrangement of the rooms in these cottages I have adopted the plan which has given most satisfaction in other sanatoria. All rooms are facing south and open into a corridor behind them, which leads into the open and to the gallery. The porches and verandahs in front of the bedrooms I have intentionally avoided, although they form a special feature in many excellent sanatoria, as for instance, the Ventnor Consumptive Hospital. Although I acknowledge their great advantage in hospitals for advanced cases, because they allow

an easy access to the open air, in a sanatorium intended for those not too feeble to walk, they only take away the sunlight from the rooms, and are apt to affect the purity of the bedroom atmosphere. The bedrooms here can be flushed by air thoroughly, without a draught on the bed. The door, which in summer is replaced by an open-work shutter and has a large open transom above, is to one side of the head of the bed and receives air from an opposite window on the corridor. The window extends to the floor, so as to allow a thorough flushing of the air space on the floor. Bathrooms, water closets and lavatories, I have put in a small annex built out to the north of the cottage and separated by a little hallway. This arrangement makes them easily accessible from every room and still sufficiently isolated to prevent any possible sewer gas or other contamination of the air.

The space thus enclosed by the three cottages and the galleries, is perfectly sheltered from the most prevailing winds in winter, and in summer abundantly ventilated and cool in the shaded parts. Within this space I have placed a raised pavilion, which is to have only a roof and removable walls toward the north. This pavilion is intended for manual occupation of patients whose condition permits such. For the same purpose the grounds around it could also be utilised for gardening and other occupations useful and diverting for the patients.

It is often surprising to what extent rest in the open air in our winter climate can be carried out, provided the wind can be kept off by adequate shelters. I have been able to keep patients out of doors throughout the winter in Chicago, where this season is not renowned for mildness. With a few planks and screens I was able to construct a most serviceable fresh air gallery on a porch, while blankets, furs and hot water bottles, together with a steamer chair, completed the outfit. I was somewhat astonished to read in the *Transactions* of this Association of last year, in the discussion of a paper read

by Dr. Gardiner, that he was able to keep his patients out of doors in Colorado for five and a-half hours daily on the average. I have been able to reach this average, counting the winter from November 1 to May 1 in most cases, and even reaching six and a-half hours in some. I feel certain that with greater facilities at command, this time can be increased, even in our climate. I do not propose to discuss the value of these prolonged out-door recreations, but I must mention that as far as my experience goes, I have found them of the greatest value, showing in gain of weight, reduction of temperature and general improvement not to be attained alone by the other measures applied at the same time, as cold and cool baths and abundant alimentation; and I have also the distinct impression that the same cannot be accomplished in well ventilated rooms. Of course they are most important, but the life of a consumptive must be out of doors.

I hope you will not think me too radical and dogmatic in my advocation of the open air plan, but during the time of some years spent together with tuberculous patients, I have convinced myself of the enormous value of such an open air *régime* and the disadvantage and often detrimental effect of half measures. I have seen patients to whom the mere suggestion of going out of doors in winter or of cold water applied to their skin, sent a visible shudder down their backs, later becoming most enthusiastic advocates of their *régime*. To carry out a plan of this kind in private practice among the poor, meets with almost insurmountable difficulties. In a sanatorium where soon a stock of model patients is trained, these measures can be carried out with comparative ease and to the greatest benefit to those most concerned.

In my plan I have figured on single rooms for each patient. That under given circumstances wards may be substituted hardly needs mention in the light of our present knowledge how to avoid infection from patient to patient. They have been adopted in other institutions and the prejudice which was

encountered in their planning soon yielded to the good results obtained in them afterwards.

As to the interior finishing and furnishing, I have but little to add. Everything apt to catch dust must be avoided. Linoleum, or some other washable material, should be used on the floors. A good heating plant is of great importance and a water supply to each room or ward most desirable. These are points which in our days of sanitary engineering, architecture and plumbing, have become much appreciated, and are applied in hospitals as well as residences. It would lead too far to enumerate all the details. It need only be said that simplicity and a cheerful appearance should be guiding features. The Rutland Hospital is a model in this respect also.

One point which I had in mind in recommending a water supply to every room or ward, needs attention. I mean to facilitate hereby the carrying out of hydrotherapeutic appliances. Usually in sanatoria there is a separate douche room, mostly in the basement, where all patients go for their douche, sponge, or whatever they are directed to take. I have found this always complicated and it does not induce the patient to carry it out after his or her discharge, while if we place in every room a round, flat tin tub which, when out of use can be put under the bed, and teach the patients how to take their sponge or bucket bath themselves, or have an attendant give it to them until they are able to do it themselves, we introduce a most valuable measure into their *régime* with comparatively simple means.

As to the management of such an institution, I should suggest putting the superintendence into the hands of one person of executive ability and proven knowledge of the requirements in such an institution, one who has sufficient authority over the patients to induce them to strictly adhere to the prescribed *régime*, and who at the same time is able to keep an eye on the kitchen. Such persons are rare, but they can be found, and I feel inclined to believe that such a position

would better be filled by a specially trained nurse than by a physician. Of course, the sanatorium should have a staff of physicians, who decide on the general plan to be followed and who, by regular visits, satisfy themselves that everything is in good order and give detail directions. But one single head to such an institution I consider of very great importance and I am certain, in time to come, the larger institutions will train nurses for such purposes, who in every respect would merit the confidence of the medical staff as well as of the patients. Besides a clerical attendant and three nurses, together with the *personnel* of the kitchen, grounds, heating plant, &c., no other attendance should be needed, as most of the other work could and should be done by the patients themselves.

Of course the plan has to be modified according to the pecuniary circumstances of the patients which the sanatorium proposes to receive. For the same reason will the rates vary which each patient has to contribute to the expenses of the institution.

This project, which I have the honour to submit to you, necessarily cannot be more than a sketch, and I shall be glad if other important points are brought out in the discussion. My desire was to call attention to one of the many branches in phthisio-therapeutics—the construction of a sanatorium—which in general does not receive the interest it deserves. The medical man who is interested in the subject has to be a little of everything, besides mastering his own profession, physicist, architect, business-man, meteorologist, climatologist and last, but not least, cook. And not as "feu Cyrano de Bergerac, qui fut tout, et qui ne fut rien."

The anti-tuberculosis movement which is now sweeping over the civilised world, led by crowned heads and supported by distinguished men, has already accomplished much good by creating an interest in a subject which has been treated most indifferently. But a movement of this kind, in order to be of lasting benefit to humanity, has to have a more substantial

basis than the mere education of the public through written or spoken advice. The appeal for the erection of sanatoria should not be put at the tail end of the programme, but should become the parole of the movement. Tuberculosis will never be stamped out by indirect measures alone. Improvements in public hygiene, the spreading of the population of cities over larger areas, facilitated by rapid means of transportation, will accomplish the result, if it ever can be accomplished. I fear that if we cannot base our efforts on the tangible foundation of results accomplished within reach everywhere, the movement so successfully begun will vanish like a castle in the air.

This Association, under whose auspices much excellent work has been done on the subject of tuberculosis, and which has as its members men who have been pioneers in sanatorium work in this country, would be the natural leaders in a national movement to accomplish definite ends.

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DISCUSSION.

Dr. HENRY P. LOOMIS (New York) said: The immense expense of running a sanatorium on the plan he has outlined must be considered. While it is the ideal plan for the patient, we cannot always afford to carry it out. The cottage plan, as carried out by Dr. Trudeau, is very expensive. There is no question as to the benefit derived by tuberculous patients from sanatorium treatment. In this matter we are far behind in this country, as compared with the other side.

Dr. C. F. McGahan (Aiken): This is a subject in which I have been interested for some years. I have visited all the large sanatoria in Europe, as well as a number of the smaller ones, and I am rather in favour of the latter. I visited the Falkenstein and other institutions, and different ones in England, and the one which impressed me most was Dr. Walters', at Norddrach. He limits the number of his patients to forty, claiming that he cannot conscientiously attend to a greater number. His buildings are so arranged that each building contains ten patients, five below and five above. The windows and doors are so arranged as to permit of very free ventilation, and there is a douche in each room. Dr. Walters visits each patient twice daily. The walks surrounding the buildings have been carefully measured and marked, so that the distance and degree of ascent is known, and the doctor prescribes just how far each patient should walk. His system is a very thorough one, and the entire management is in his own hands. At Aiken I have a little charity colony of consumptives, modelled after the plan of Trudeau and Bowditch, and I find that I can only take care of eleven patients. Bowditch can take care of nine. It costs me from 8 dols. to 9 dols. per week for each patient.

Dr. E. O. Otis (Boston): I very much regret that Dr. Bowditch is not here, as he is one of the visiting physicians at the Rutland Sanatorium, to tell us of his experience there. I wish to express my extreme gratification in listening to Dr. Klebs' paper, and to say that I sincerely believe that the future treatment of a large number of cases of tuberculosis will be carried out in sanatoria located near the large cities, from whence most of the patients come. It has been a revelation to me to see the awakening on this subject throughout the country, and in my own State of Massachusetts this is exemplified by the experience of the sanatorium at Rutland. The people's eyes have been opened to the fact that tuberculosis can be cured right in their own State, and within a few weeks a bill has been presented to the Massachusetts Legislature and favourably received, advocating an appropriation of 150,000 dols. for the erection of a second sanatorium. The one which has been in existence for a year at Rutland cost 170,000 dols., and I think the State will be willing to expend this additional amount, as they realise the importance of the work which has been accomplished at Rutland. The weekly expense of each patient at Rutland is 8 dols. 40 cents. It is of interest to note that one of the patients who graduated there has opened a place near by for the overflow cases, as the sanatorium is now filled to its capacity at an expense of 5 dols. *per capita* a week; he carries out to a degree the same *régime* as that in force at the sanatorium, and is said to give the patients good care and food. I am firmly convinced that the sanatorium treatment of tuberculosis has come to stay, and when once a State has come to realise the benefits to be derived from it, as we have in Massachusetts, they will not only favour the appropriation of money from year to year, but will multiply their sanatoria one after another.

Dr. Carroll E. Edson (Denver): Regarding the importance and desirability of sanatorium treatment there can be no question in the mind of any of us. One objection to the plans shown by Dr. Klebs is the expense

attached to carrying them out. We all feel that the sanatorium treatment should be placed within the reach of more tuberculous patients than can now afford it, and in dealing with this question we should not forget that the essential principles of that plan of treatment can be carried out on a very small scale. There are very few of us who cannot start a sanatorium for at least one or two patients. All it needs is a good house, properly located and well ventilated. In addition to this there should be a properly constructed porch, with a good housekeeper. If these few essential principles are acted upon, we need not wait for the erection of an institution like that at Rutland, or Liberty, or Falkenstein; in fact, we can almost start a sanatorium in our own back yard.

Dr. J. EDWARD STUBBERT (Liberty): One of the most important questions in connection with the erection of sanatoria is the expense, and in dealing with this we must bear in mind that we have two classes of patients to consider, namely, the rich and the poor. It is not crime for a man to have money, and on the other hand, it is no crime to be poor, and the one class must help take care of the other. As Dr. Loomis said, the small cottage plan of sanatoria is the most expensive, but it possesses decided advantages. I find at Liberty that the majority of the patients do not like to be placed too close to each other, as the constant coughing and association with their fellow-patients annoys them. I think we should aim to follow the plan of Dr. Trudeau and separate our sanatoria into widely distributed cottages.

As to the question of the size of a sanatorium, that should depend largely upon how many patients can be properly supervised. One doctor can only handle a certain number of patients, but if proper discipline is maintained the inmates can be sub-divided into divisions and placed in charge of properly trained subordinates, while the physician-in-charge supervises the work and sees the patients personally at longer intervals. The expense of each patient is in proportion to their number. The larger the number of patients in an institution, the smaller the expense *per capita.*

In the treatment of sanatoria patients, the question of proper amusement is an important one. At Liberty during the past year we have introduced amateur theatricals with very satisfactory results. During the summer the patients rehearse in the woods or on verandahs; this keeps their minds occupied.

Dr. E. R. BALDWIN: I simply wish to add a word about the expense of cottage sanatoria. At the Saranac institution the expense for each patient is from 7 dols. to 8 dols. per week, the highest being about 7 dols. 95 cents. In this connection it must be remembered that Dr. Trudeau does not receive any compensation for his services. Assuming that we had a salaried man at the head of the institution, the expense of each patient would probably be increased to about 8 dols. 50 cents. per week. The expense of each patient in the cottages outside the sanatorium varies from 8 dols to 15 dols. per week, or more, according to the individual tastes of the patient.

The question of expense is one which appeals to most of us as a very

difficult one to regulate. The majority of the patients look for moderate-priced quarters. The Saranac institution was started in a very small way and gradually increased, until now we have about a hundred patients. The expense of running it naturally decreases with the number of patients, but Dr. Trudeau believes that an institution with more than one hundred patients is rather unwieldy.

Dr. NEWTON: I would like to make a proposition to the Association. It may perhaps be premature to speak of it now, but I wish to mention it, at any rate. I do not see why we cannot start a Coxey army movement in every large city in this country. Let the army be composed of invalids and incipient cases of tuberculosis, and under a proper leader, let it be taken to the country on a tramping-trip and camp out in the open air for a month or two. The change of air and surroundings will stimulate the vital functions. We know that even moving from one room to another does this. We have all heard of the benefit which Dr. Bowditch's grandfather derived from his driving tour.

Dr. KLEBS (closing the discussion): On account of the brevity of the time at my disposal I was unable to read my entire paper, and perhaps on that account I did not make myself quite clear. If Dr. Loomis thinks that the plans which I showed resemble those of the Institution at Rutland, and that its great expense may be prohibitive, he must have misunderstood me. The estimates show that it is inexpensive, and this was one of the chief points I had in view in proposing it, without reducing its value in the open-air treatment in the least. I entirely agree with the statement made by Dr. Edson that any properly constructed house, well located, can be remodelled into a sanatorium.

OBSERVATIONS ON THE PHLEBITIS OF ADVANCED PHTHISIS, AND PHTHISIS AND TRAUMATISM.

BY ROLAND G. CURTIN, M.D.

I.—Observations on the Phlebitis of Advanced Phthisis.

In the course of a practice extending over a third of a century, I have seen a number of cases of phthisis with a complication which, so far as I can find, seems to have almost escaped observation. I have noticed sixteen cases of more or less well-marked phlebitis of the veins of the thighs and legs. This complication occurred during the early or middle part of the last stage of acute or sub-acute phthisis. The symptoms did not tally with those of the swelling of the legs which immediately precedes death, but took place much earlier and then subsided. The condition was a separate and distinct one, of acute inflammatory origin, and was followed later by the usual symptoms of swelling of the lower extremities which takes place just before dissolution occurs.

The first case that I saw was that of a young girl, aged 18, with acute pulmonary tuberculosis running its course in about four or five months. She had a marked increase of temperature — two degrees above that which she had had previously — with a dry skin, increased frequency of the pulse, thirst, a dry tongue, and tenderness along one femoral vein, which later extended down the limb to the ankle. After the symptoms in the first leg had run their course and subsided, the same condition attacked the other,

subsiding later in the same manner as in the first lower extremity. The feverishness decreased, returning to the temperature that had prevailed before the attack; the soreness of the limb subsided, as did also the swelling, until it disappeared entirely. This was about two months before death.

The observations that I have made upon this class of cases all tally in more or less marked degree with the case just described, the symptoms differing in severity and the time of occurrence, being in most cases weeks or months before the death of the patient. I have placed the symptoms that I have observed in tabular form, showing the differential diagnosis between the phlebitis and the œdema of the feet which usually precedes death in cases of pulmonary tuberculosis.

Phlebitis.	Œdema of the Feet at the end of the last Stage of Pulmonary Tuberculosis.
Marked increase of fever.	Fever generally not increased.
Marked pain along veins.	No pain, only stiffness below knee.
Marked soreness along veins.	No deep tenderness, skin tender.
Secretions diminished.	Secretions not diminished.
Skin hot.	Skin not hot.
Patient excited and irritable.	Patient feeble and weak.
Swelling decreases in a few days.	Swelling continues to the end.
Symptoms subside.	Symptoms followed by death.
Symptoms usually occur weeks or months before death.	Symptoms occur just before death.
Symptoms generally commence above knee.	Symptoms begin below knee.
Generally in the female sex.	Both sexes alike.

It will be seen from this tabulation that the complication to which I call attention is inflammatory, and that its advent is much earlier in time than the common swelling of the feet, which is considered by physicians, as well as by the laity, as a forerunner of death. In this connection the following questions might be raised :—

(1) Is the swelling of the feet in the latter part of the third stage of phthisis caused by latent inflammation or a throm-

botic condition of the veins? (2) Are the veins tubercular, becoming involved in the last stage of the disease? (3) Is the swelling caused by the extreme weakness of the circulation? (4) Is it produced by the poor condition of the blood? (5) Is it a stasis of the blood in the veins from the interference to the passage of the blood through the diseased lungs? (6) Can it be a combination of poor blood, weak or retarded circulation, and thrombosis?

It has occurred to me that this phlebitic condition might point to a solution of the question. The system being stronger at an early stage in the disease is able to react sufficiently to produce the febrile and other symptoms before mentioned. I have looked in vain in the literature on the subject of phthisis for any description of the phlebitic complication herein described. I have seen physicians and others placed in an awkward position through this complication, they having stated that the swelling indicated death in a few days. The patients recovered from the symptoms, and the prophets were thought to be poor prognosticators.

I have never had an opportunity of making an autopsy, so as to prove whether or not the inflammation of the veins was of tubercular origin. Perhaps these cases may have been where there had been a double infection, the phlebitis being the result of the action of the associated bacteria.

II.—Observations on Phthisis following Traumatism of the Lung and Pleura, Abscesses of the Hand, and a Foreign Body in the Bronchial Tube.

A. Phthisis following Traumatism of the Lung and Pleura.

The six cases that I report in this paper have interested me. Although somewhat dissimilar I have grouped them together. The first three were the result of bicycle injuries,

the patient being thrown to the ground, striking on the anterior chest-wall, with no evidence of external injury.

CASE 1.—Mr. B., aged 20, was riding on a country road after dark. His wheel caught in a rut and he was violently thrown to the ground, striking his right chest anteriorly at the fourth rib, near the nipple. He expectorated blood at the time of the accident, and later had a number of profuse hæmorrhages, some fever, and evidence of consolidation of the base of the right lung. He is now living in the South, endeavouring to maintain an existence, having chronic pulmonary tuberculosis.

CASE 2.—Mr. B., aged 21, was riding his wheel at night; he was thrown, as in Case 1, striking the anterior chest, left side, near nipple. No marks were found on the surface. He had pain of pleuritic character, followed by pneumonia of the left side, and later on by a pulmonary abscess of the same side. He has now evidence of latent pulmonary disease.

CASE 3.—Mr. K., aged 28, was riding down a steep hill towards a railroad crossing. The man at the gate shut it as Mr. K. approached. In order to avoid crashing into the gate or the train, he ran into a bank and was thrown off, striking violently on the middle of his left anterior chest. There was no external discolouration. Following this he had pleurisy, and later pulmonary tuberculosis, from which he died fifteen months later.

In New York last year, Dr. Newton reported a case of rupture of the heart following a not very severe blow upon the chest wall in a bicycle collision. That case showed that severe internal injuries may result without the chest wall's showing any evidence of injury. In these cases to which I have called your attention the pleura, or even the lung might have been severely injured, giving rise to the symptoms found in them at a later period. Hard pressure and marked shocks on the chest do not always, however, cause pleurisy or inflammation of the lungs; this is shown by the infrequency with which

football players suffer from these affections, and yet they are subjected to great pressure and to more or less sudden shocks, especially of the chest. On the other hand, it is said that the hard blows on the chest received by pugilists frequently cause tuberculosis. In the injuries received by the patients whose cases are herein reported, the body was suddenly thrown to the ground while moving forward with a greater or less degree of rapidity, thus giving a velocity to the body in its impact against the earth. Such an injury would be more likely to cause a contusion of the internal organs than would the shocks usually received by prize-fighters and football players. I feel quite sure that in the cases that are reported in this paper the pleura at least, was injured, and in one case the lung itself seemed to be also, because pulmonary hæmorrhage set in immediately after the accident.

In analysing the records of the prize ring, it was noticed by the late Dr. W. L. Axford "that traumatism plays a part in the production of the phthisis which is notoriously common among prize-fighters." Lebert and Scholtz had published clinical observations which tended to show that "traumatism may become the direct cause of pulmonary tuberculosis." Mendelsohn, Bremer, Jaccoud and others, have pointed out that their observations confirm those of Lebert and Scholtz. Dr. Eloy stated that "a person previously in good health, who sustained a traumatism of the chest wall without any external wound, soon after developed symptoms of pneumonia and hæmoptysis, which latter assumed the character of acute phthisis. It is possible that in some cases the injury merely disturbs the circulation and starts inflammation, which favours an attack of tuberculosis." Mendelsohn suggests that the tuberculosis may be engrafted into the patient in the hospital to which he is taken for treatment, but this would not apply to my cases, for they were treated at home. In Dr. Eloy's opinion, "The most acceptable view, in our present state of knowledge, is that the injury produces a modification of the

nutrition of the pulmonary tissues, which thus afford a more favourable nidus for the growth of the bacilli. The occurrence of phthisis after traumatism of the chest without external wound, must be regarded as an established fact ; and hence, appropriate prophylactic measures are called for in all cases of chest injury, especially if there is a family history of tuberculosis."

In one of my cases tuberculosis followed the injury to the lung ; in the second the injury was probably only of the pleura ; in the third the pleura and the lung both showed evidence of disease some time after the accident in a pleuro-pneumonia, and later by a pulmonary abscess, and finally resulted in a chronic ulcerated condition of the lung.

The fact should not be lost sight of that pugilists are particularly tempted by sexual and alcoholic excesses, and these may be the cause of much of the tuberculosis found among them. Moreover, the evidence of lung disease does not usually date from the time of the fight, so that they cannot be properly classified with the cases to which I have just called attention.

B. Phthisis following Abscesses of the Hand, which resulted from Traumatism.

In two of the cases of abscesses of the hand (one being of the right, and the other of the left hand) puncture of the skin was followed by an inflammation of the lymphatics, and later by symptoms of abscess of the corresponding lung. In one case the abscess was evacuated promptly through a bronchial tube. The pulmonary abscess was followed by tubercular disease, which afterwards involved both lungs, causing death. The other case, the abscess of the right hand was followed by an abscess of the right lung, which was followed by recovery. In the sixth case a bone was swallowed, which passed into a bronchial tube. An irritative hoarse cough followed imme-

diately after the swallowing of the bone. Two months later the patient began to spit purulent matter, and at times altered and streaked blood. Four months after swallowing the bone she coughed it up. It was wedge-shaped, measured half an inch in length, and was pointed at one end; on the other end it measured $\frac{1}{4}$ by $\frac{1}{2}$ an inch. A little over a year later she was seen in a dying condition, with copious expectoration, which contained numerous tubercular bacilli, streptococcic pus and lung tissue.

DISCUSSION.

Dr. NEWTON: I would like to inquire about the statistics of tuberculosis among prize-fighters. I think the number of cases is probably very small, although the common opinion seems to be that it is large.

Dr. CURTIN: I failed to read that portion of my paper in which I said that it was doubtful whether tuberculosis among prize-fighters was due to their occupation or to the dissolute habits of that class of men.

Dr. BABCOCK: I have seen three cases of phlebitis in tuberculosis, one in a young man of thirty, which affected first the saphenous vein of the left leg and subsequently that of the right. The other two patients were elderly females. One of them I saw with Dr. Bonney in Denver last June.

Dr. THOMAS D. COLEMAN: About a month ago I had under my care a patient who had been operated upon in New York for tubercular peritonitis. Following the operation he developed a phlebitis in the larger vein of the upper extremities. He finally died of general anasarca. In this case there was a general vascular fibrosis—the vessel walls being greatly thickened and tough like whip-cords.

Dr. ANDERS: I have seen two cases of phlebitis secondary to chronic phthisis. These cases have been regarded as cases of thrombo-phlebitis, or phlebitis from within. In the last two cases to which the doctor referred, in which the phlebitis followed an injury to the hand, with resulting abscess, we have perhaps a different mode of origin. In those cases there may have been an inflammation of the vein externally, which spread to the media and intima and was followed in turn by a thrombus, and after softening had occured, emboli may have become detached and passed into the lungs.

Dr. SOLLY: Dr. Newton referred to the supposed frequency of tuberculosis among prize-fighters. Some years ago I investigated that subject, and came to the conclusion that in prize-fighters who contracted the disease, it could not be laid to their occupation. John Heenan, the man who fought Tom Sayers and who died from tuberculosis, was a sober man. In his case the disease was possibly attributable to the results of a railroad accident in which he was injured.

I was particularly interested in the two cases reported by Dr. Curtin, where pulmonary tuberculosis followed an abscess of the hand, the lung on the same side of the body becoming affected ; because it appears to parallel my observations upon the frequency with which stenosis of the nose and tuberculosis of the lung occur upon the same side of the body.

Dr. NORMAN BRIDGE (Los Angeles) : I hope we shall not devote too much time to the pugilists, as the question of phlebitis in pulmonary tuberculosis is very interesting. I saw such a case two months ago. The patient was a man of 26, who had had tuberculosis of the left lung for two or three years. While he was up and about, with trifling fever, feeling fairly well, he developed a phlebitis in the right groin. It was very painful, and the entire extremity became swollen and tender. There was considerable fever. These symptoms gradually subsided, and were followed by an exactly similar occurrence on the opposite side. This patient, apparently, has entirely recovered. The swelling of the legs and feet has disappeared, and the blood-vessels cannot be felt.

It seems to me that it is impossible to say that a case like this one is, strictly speaking, tuberculous. I admit that it not infrequently occurs in tuberculous patients, and I agree with Dr. Anders that it occurs from within. The question is, what makes it occur from within ? Why does it happen ? Why does it happen that the inside of the veins become lowered in their vitality, and their surfaces become roughened, so that a thrombus is allowed to form ? It strikes me, from the investigations thus far made, that we should regard these cases as somewhat analogous to the cases of rheumatoid joint troubles in this class of patients. That they are tuberculous I do not think is proven, any more than it is that in all cases of pleurisy with effusion tuberculosis exists. We are not warranted in saying that, unless we find the bacilli, or can develop tuberculosis by injecting the effused fluid into the lower animals

Dr. BABCOCK : I believe the phlebitis in these cases is due to infection : whether the infection is simple or mixed we do not know, but it is manifestly an infection.

STOMACH CONDITIONS IN EARLY TUBERCULOSIS.

BY BOARDMAN REED, M.D.

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In what has been incorrectly styled the pretubercular, but should be called the incipient, stage of consumption the most noticeable symptoms are often those of flatulent dyspepsia, with eructations and pyrosis or heartburn with or without gastric pain, nausea and even stubborn vomiting. These are sometimes symptoms merely of a lowered nerve tone, and at other times evidences of actual gastric involvement.

All the possible affections of the stomach can, of course, precede tuberculosis. Indeed, its development must be favored by gastric dilatation, the various forms of chronic gastritis, and a failure, or persistently depressed activity, of the peptic glands, from whatever cause, nutrition being lowered in this way to a degree which may render infection possible.

Moreover, it is probable that, contrary to general belief, hypersthenic conditions in the stomach, such as hyperchlorhydria and acid gastric catarrh, are quite as compatible with a tubercular infection as are the asthenic types of gastric disease. For it is now known that a large proportion of the cases of early phthisis—a preponderance of them, according to some observers—have an excessive secretion of hydrochloric acid.

Though not a very large number of reports of analyses of the stomach contents in the early stages of tuberculosis are to be found in medical literature, and this question, therefore, cannot be said to have been positively decided, the evidence so far available points to the conclusion that, except in the

advanced cases with continuous fever, there is at least quite as likely to be an abundant secretion as a deficiency of HCl in the stomach.

Van Valzah and Nisbet,[1] in forty-seven cases of incipient phthisis, found in ten no signs or symptoms of any gastric derangement. Three out of the same series had chronic gastritis with an absence of free HCl, a diminished proportion of combined HCl, &c. In eighteen of the cases there were traces only of free HCl and diminution of secretion otherwise. In thirteen of this last number there was mild, and in five severe, stagnation with fermentation.

Among the sixteen remaining of the forty-seven cases, three were found to have acid gastric catarrh—*i.e.*, the sthenic form of chronic gastritis with an augmented secretion of HCl; seven had the acid in excess with motor insufficiency, stagnation and delayed evacuation; and in the other six there was also hyperchlorhydria with fermentation in all, while in two of them the stomach was unable to empty itself even during the night.

In twenty-six cases, first examined by the same authors during the stage of consolidation, four were normal as to gastric juice, five had chronic asthenic gastritis, one had a trace only of free HCl, and in thirteen the secretion was variable, which means that sometimes it was in excess, and at other times normal or deficient.

Thus in forty-seven incipient cases there were twenty-six, or 55 per cent., with either a normal or over acid gastric juice; and of the twenty-six in the stage of consolidation, in four, or 15 per cent., the secretion was normal constantly, and in 50 per cent. more it was variable, that is normal or above a part of the time. In 65 per cent., therefore, of the seventy-three comparatively early cases studied by Van Valzah and Nisbet, the secretion of the peptic glands was normal or above at least a part of the time.

[1] "The Diseases of the Stomach." Phila.: W. B. Saunders, 1898; page 646 *et seq.*

Riegel[2] quotes Klemperer as thus summing up the results of his observations in fourteen cases, ten of early, and four of more advanced phthisis; "In the beginning the secretory capacity of the stomach was mostly increased, often normal, seldom lowered; in the final stage markedly lessened." Klemperer found, however, that in all the forms of dyspepsia associated with tuberculosis the motor function of the stomach was depressed.

Brieger,[3] quoted by Riegel, studied sixty-four cases of tuberculosis, all except six of which were in a more or less advanced stage. In such a series there would naturally be a preponderance of depression in all the gastric functions. Still, in 16 per cent. of even the more severe cases, Brieger found a normal condition of the gastric juice, while the same was observed in 33 per cent. of the cases classed as moderately severe. In the four incipient cases he found two with normal secretion and two with disturbed chemism, the inference being that in the latter there was a variable condition.

Riegel[4] states that the results of his own observations accord in the main with those of Klemperer and Brieger.

Croner[5] in thirty-six cases of early phthisis found in only five a complete failure of HCl. The total acidity varied from twenty-one to eighty, but was in most cases normal. He does not seem to have determined the proportion of free HCl, and must have relied upon imperfect tests of motility, since, contrary to most other observers, he reports not having found a lack of motor power in any of the cases.

Unfortunately for the cause of medical science and for the best interests of patients, physicians in general practice rarely make themselves, or have made, tests of motility or analyses of the stomach contents except when cancer is suspected, and

[2] *Erkrankungen des Magens.* W en.: Alfred Hoelder, 1897, pp. 946-947.
[3] *Loc. cit.*
[4] *Ibid*
[5] *Deutsche Med. Woch.*, 1898. No. 48.

the pulmonary specialists, I fear, have been in the past almost equally indifferent to the modern exact methods of studying the gastric functions. During fifteen or more of my own busiest years of practice, when I saw many tubercular cases, I have to confess having never made a chemical analysis of the gastric contents, or even employed the simpler methods of determining the motor power of the stomach. And now that my work is limited almost exclusively to chronic diseases of the digestive system, I do not often have the opportunity of seeing tubercular patients. The following case, however, which is now under my care, presents some features of peculiar interest.

A married lady, aged 29, resident in a neighbouring city, consulted me in November, 1899, on account of a stubborn and aggravated form of dyspepsia with morning nausea, much pain in both stomach and spine, accumulations of gas in stomach and bowels, light fever of a hectic type, slight perspiration at night, considerable emaciation and much debility. She had been treated for malaria with quinine, &c., and had also taken much creosote without apparent results, unless a very marked hyperchlorhydria could be considered a result. She has a lateral curvature of the spine dating from girlhood, and wore for years at that time a plaster jacket.

The results of my examination in her case were as follows :—

Liver normal, kidneys not palpable. Heart normal as to size and sounds. Apex beat in right place, but not strong. Stomach enlarged from normal above to level of the umbilicus. Weak motility. Pelvic organs: Uterus slightly retroverted. Tender on palpation in region of left ovary, but no swelling could be made out in the adnexa. The stomach contents one hour after the usual test breakfast showed the percentage of free HCl to be ·233 (2·3 per 1,000), and the T. A. 90.

Tuberculosis was naturally suspected by me at once, though there were no abnormal signs in the lungs and no cough

except after colds. No sputa could be obtained, and no bacilli were found in the stomach contents. The blood was examined for the plasmodium of malaria twice with negative results. Finally, diagnostic doses of tuberculin were cautiously administered three times at intervals of twelve to twenty-four hours, beginning with 11 cc. of a 1 per cent. dilution prepared with a ·75 per cent. aqueous solution of carbolic acid and increasing to ·5 cc. finally. After the third injection there was a decided reaction with a temperature two degrees higher than the average at the same time of day for a week or more before. There was also severe headache and backache, sleeplessness and some sharp pains about the neck and throat, but no other local reaction could be made out, except that a few slightly enlarged glands on both sides of the neck were markedly swollen and somewhat tender.

The secretory function of the stomach proved extraordinarily sensitive to drugs. It fell rapidly within a few days after putting her on full doses of soda and belladonna, all the free HCl disappearing, and then, on withholding these medicines, returned gradually to the normal. Even moderate doses of almost any tonic medicine showed a tendency to make the percentage of free HCl go up again above ·100. The treatment has been mainly by diet, out-door air and gentle exercises, with the help of galvanism to the spinal centres and over the course of the pneumogastrics in the neck, as well as of faradism through the stomach externally. Intragastric electricity was also administered for some time, but though helpful, was not so well borne as it is by most other patients. At one time during the past winter, while she was in a suburb of Philadelphia under my care, there was, after some imprudence in diet, an increase of the gastric pain with such marked tenderness locally as to make one think of the possibility of gastric ulcer. She was then kept in bed, either on the piazza or in a room with the windows all open for two weeks, on a diet mainly of milk, and was given large doses

of bismuth according to Fleiner's method. The result was decided improvement in all ways. The patient has since had periods of gaining markedly in strength and weight alternating with less well intervals, but there has been no fever since her recovery from the reaction following the diagnostic use of tuberculin three months ago. As to medicines, this patient has tolerated well and responded favourably to one-drop doses of creosote combined in capsule with cod-liver oil, minute doses of arsenic, and at times, even when there has been too much HCl in the stomach, has found help from the administration of some of the digestive preparations made from the carica papaya plant. She has been at home for some time past carrying out the line of treatment prescribed by me and is on the whole much improved, though it is difficult to induce her to remain as much in the open air as she ought to be.

The series of cases reported by Van Valzah and Nisbet, by Brieger and by Klemperer, show that in early tuberculosis there is present very frequently—and probably in a majority of cases—a condition of the peptic glands which contra-indicates the administration of any considerable doses, by the stomach at least, of highly stimulating remedies such as carbolic acid, creosote and its derivatives, the mineral acids, and most of the familiar stomachics. That is, in these cases when the gastric function is not entirely normal, there is usually either an excess of HCl, or an impressionable and variable condition of the secretion, a condition in which the exhibition of stimulating drugs produces harmful irritation resulting often in hyperchlorhydria which complicates the treatment of the tuberculosis and lessens the prospects of cure. Riegel's experience agrees with that of the authors cited, and my own case well illustrates the point just made, besides showing how tuberculosis for a long time may masquerade in the guise of a stomach trouble.

In the light of these facts, it is easy to understand why such

directly opposite views are held by clinicians of equal ability as to the value of large doses of creosote and of other irritant drugs in tuberculosis. Whether the remedy does good or harm, depends mainly upon the condition of the stomach, and, it not having become yet the settled practice, as it ought to be, always to ascertain the state of the gastric functions before pursuing an active drug treatment in any chronic disease, a confusing contrariety of results follows such modes of treatment.

For exactly the same reason, the profession is divided as to the value of cod-liver oil in pulmonary phthisis. Recent experiments prove that the oils markedly lessen the secretion of HCl in the stomach.[6] In the cases, therefore, in which the gastric functions are almost always depressed, as in the later stages of phthisis, cod-liver oil, or much fat of any kind, impairs digestion and injures the patient, whereas, in the cases of hyperchlorhydria, which are so often found in the earlier stages, the same remedy exerts a double influence for good, since here it tends to correct the injurious hypersecretion at the same time that it helps to fatten and strengthen the patient. In the cases between these extremes—cases in which there is a nearly normal gastric secretion—a moderate amount of oil may prove helpful for a time, and by means of an occasional analysis of the stomach contents to see when it has begun to depress secretion unduly, advantage may safely be taken of its valuable medicinal and nutrient qualities.

Let me turn aside right here to advise that in doubtful cases, in which an analysis of the stomach contents is not practicable, as well as in cases in which the gastric juice has been found to be about normal, it would be well to combine creosote or one of its congeners with cod-liver oil so as to have the stimulating properties of the former neutralise the depressing influence of the latter upon the peptic glands.

[6] Bachmann, "*Experimentelle Studien über die dietetische Behandlung bei Superaciditat.*" *Archiv. f. Verdanungs-Krankheiten.* Band v. Hft. 3.

The majority of competent observers agree that the motor function of the stomach, which is always seriously lowered in advanced phthisis, is very apt to be depressed somewhat in even the earlier stages. That is, the muscular walls of the organ lose their tone and there results a tardy evacuation of the contents with consequent stagnation and fermentation. This weakened motility must be overcome before tubercular patients can get well.

Drugs are of little avail for this condition, but breathing exercises, especially in the open air as from hill climbing, and bicycling and rowing, are highly curative in conjunction with a diet which is at once digestible, nourishing and not too bulky. We should avoid in such cases overloading the stomach, and much liquid should not be taken with the larger meals. Pulley exercises and gymnastics for the trunk muscles generally are very useful. Massage of the abdomen can also do great good, except when the gastric glands are irritable and inclined to over-action ; then it can over-stimulate and do harm, as has been pointed out by me in a previous paper.[7] Intragastric faradism is also most helpful, but must be used with discretion.

The points emphasised in this paper may be thus summarised :—

(1) In early tuberculosis the secretion of HCl in the stomach is very frequently excessive, the peptic glands being in a condition of irritability which causes stimulant remedies of the creosote class to disagree and act injuriously.

(2) Oils tend to depress the secretory function of the stomach, and in consequence cod-liver oil is likely to help the cases which the creosote class of drugs hurt, but, on the other hand, hurts the cases in which the gastric secretion is inactive, the very ones in which creosote and the like often do good.

(3) Therefore, it ought to be the rule to ascertain the con-

[7] "Massage of the Abdomen," by Boardman Reed, M.D., *Internat. Med. Mag.*, January, 1898.

dition of the secretory function of the stomach before pushing either class of remedies.

(4) When analyses of the gastric contents cannot be made, it is safer to combine creosote with cod-liver oil, so as to let one neutralise the other in their influence upon the stomach.

(5) The motor function is very generally depressed in tuberculosis and must be restored before a cure can be brought about. Drugs can accomplish little in this direction, but diet, exercise, especially in the open air, faradism and abdominal massage—except when hyperchlorhydria complicates—are all valuable means of effecting the result.

DISCUSSION.

Dr. James M. Anders (Philadelphia): The paper brought to the attention of the Association by Dr. Reed is of great practical importance, and it has raised many interesting points for discussion. I am thoroughly in accord with the view that in the vast majority of cases of tuberculosis in its early stages there is hyperchlorhydria from time to time at least, if not constantly. In one case which I saw, the free acids were about normal, and in another there was subacidity. My recent experience points to the fact that there is great variability in the percentage of hydrochloric acid present in the early stages of this disease, hence the gastric symptoms are probably dependent upon a functional disturbance of the organ. Those of us who have made autopsies upon patients dying of chronic phthisis know that there are many cases in which the stomach shows no lesions after death, in spite of the presence of gastric symptoms during life. This is another argument in favour of the theory that such disturbances are of a functional nature.

I was rather surprised to hear Dr. Reed say that he had found the motility of the stomach diminished in the early stages of tuberculosis. In my own experience, it has generally appeared to be about normal.

SPLENIC-MYELOGENOUS LEUKÆMIA WITH PULMONARY TUBERCULOSIS.—REPORT OF CASE.

BY HENRY L. ELSNER, M.D.

AND

WILLIAM A. GROAT, B.S.

THE association of pulmonary tuberculosis with any variety of true leukæmia is exceedingly rare. Medical literature contains the reports of several cases, in which there was a combination of lymphatic leukæmia with tuberculosis. In the terminal stages of pseudo-leukæmia, far-reaching tuberculous changes in the various organs of the body are frequently found.

Splenic-myelogenous leukæmia, combined with tuberculosis, is of such rare occurrence that there is practically no literature on the subject at the present time. The rarity of these complications is made positive by the fact elicited through private correspondence, that clinicians and pathologists of such wide experience as Stengel, Osler, Cabot, Prudden, and Janeway have never seen a case.

The case which we are about to report is one of splenic-myelogenous leukæmia, associated with advancing pulmonary tuberculosis. The physical signs, the blood and sputum examinations, are characteristic, and make the diagnosis positive.

On December 25, 1899, Dr. Breese referred Mr. Daniel O. to us for diagnosis. The patient is a baker, was born in Ireland, is a married man, aged 40. He has one child aged 17 months, to all appearances perfectly well. His environ-

ment has been favourable, though his habits have not always been good. For several years he has been addicted to the use of whiskey, but says that during the past few months he has not taken spirits.

Family History.—The father of the patient is 70 years of age, and is enjoying excellent health. The mother died after several years of sickness, during which there was progressive loss of weight. Her symptoms were suspicious of general tuberculosis. One brother died of pulmonary tuberculosis at the age of 30; another brother died of typhoid fever; otherwise the family history is negative. He denies having had syphilis; had gonorrhœa twelve years ago. After his 20th year he had measles.

Present Illness.—For many months before the advent of continuous symptoms, the patient complained of a sense of fulness in the abdomen and a progressive increase in its size. His general health had been below par. He was less active than usual, and had become depressed. Early in the spring of 1899 the patient complained of feeling tired, felt that he was growing weaker from day to day; his work became irksome. Increasing general malaise, with a sense of weight in the abdomen, were among his most annoying symptoms. He says that he was so weak after finishing his work that he was forced to take a drink of whiskey before going home. These symptoms persisted three or four weeks, when he noticed that his abdomen was becoming more and more prominent. During the summer the abdominal symptoms increased, the most prominent being the sense of weight, a dragging sensation, occasional pains; these were never severe, but caused more or less faintness.

About November 15, 1899, his colour changed. He noticed that he was growing pale and sallow. Exercise or any muscular effort caused shortness of breath. About this time he commenced to cough, and during the last days of November he had occasional night sweats. From November

15 until December 25, 1899, he averaged about three night sweats each week. After December 25 his night sweats became more frequent. At the present time he has these every night unless controlled by medicines.

About November 20, 1899, the patient's cough was so troublesome as to require treatment, and it was not until that time that he consulted a physician. He continued with his first physician but a few days, when he consulted a second, owing to the recognition of a tumour in the abdomen. His second physician called a third in consultation. It was decided that he had a tumour, and he was recommended to go to the hospital. About this time (December 25, 1899) Dr. Breese was called to see the patient. His leading symptoms were cough, pains in the back and across the abdomen, night sweats and slight fever. His temperature averaged between 101° and 102° F. His pulse was uniformly accelerated.

When Dr. Breese sent the patient to us for examination his temperature was 100·2° F. in the morning, pulse 96 and respirations 28. The colour of the patient was characteristic. He appeared sallow, anæmic, and his face looked puffy. His weight was about 150 lbs. He had lost about 15 lbs. during the preceding three months. Close questioning failed to show that he had ever suffered from enlarged cervical glands or enlargements of any kind in any part of his body.

A few days after we first examined the patient, he developed pleurisy without effusion, and during the following three weeks had a temperature which averaged 102° F. His pulse remained accelerated. From this acute complication he made a slow recovery, and believes that his general condition has been slightly improved since. The patient's cough has grown more annoying, however, and during the past five weeks has kept him awake more or less during the night.

The expectoration from November 15, 1899, until about the middle of January, 1900, was thin and watery, with

occasional streaks of blood. Since January 15, 1900, the expectoration has become thick, greenish in colour, mucopurulent and numular. Repeated bacteriologic examination of the thin sputum before February 20, 1900, failed to show the presence of tubercle bacilli, though there were occasional shreds of fibrous tissue. Since that time, with an increase of, and change in, the character of the sputum, tubercle bacilli have been found. The expectoration continues to be blood-streaked.

On April 7, 1900, the patient complains of more profuse night sweats than ever before. He says that his cough is growing more harassing, that the sense of weight is almost constant; in fact, the abdominal symptoms have increased during the past two weeks. There are no symptoms referable to the eyes; he rarely has tinnitus aurium; he has a slight nasal catarrh; examination of the mouth and fauces is negative; the teeth are fairly well preserved; the tongue is moist, heavily coated; breath is offensive; the skin presents the same characteristic appearances, considerably increased, which were noticed when the patient was first referred to us.

Physical Examination.—The superficial glands throughout the body are not palpable; there are no cicatrices visible. The heart sounds are normal; the abdomen is abnormally prominent, and the abdominal veins are enlarged. Muscular development is fair.

Lungs.—On December 25, 1899, inspection shows the thorax well developed, excursions of its left half less free than are those of the right. The pectoral reflexes on both sides are enormously exaggerated. Percussion gives high pitched resonance at the left apex in the supra- and infraclavicular regions, the dulness is continuous with that of the cardiac region. Posteriorly in the left supra- and interscapular regions, the percussion note is flat. Both anteriorly and posteriorly there is roughened and markedly exaggerated

breathing; vocal fremitus and voice sound are decidedly increased. The percussion note at the right apex anteriorly is found clear, while posteriorly in the interscapular region it is abnormally high pitched, and the breathing is bronchial in character.

On April 5, 1900, the areas of dulness and flatness are found increased. In the upper half of the interscapular region on the right side there is cavernous breathing. These changes are shown in the accompanying diagrams. On the anterior surface of the posterior laryngeal wall there is deep tuberculous ulceration. The patient has been hoarse during the past month. The temperature was 100 F., pulse 96, respirations 24.

Liver.—The liver reaches to the upper border of the fourth rib anteriorly. In the epigastric region the liver dulness is almost entirely lost in the flatness caused by the enormously enlarged spleen.

Spleen.—The left half of the abdomen is occupied by the spleen, which reaches about three fingers' breadth beyond the median line towards the right. The percussion note of the abdomen is flat, except in the dependent regions on the right side and over the ascending colon. The border of the spleen is smooth, except in the umbilical region at the extreme right, where the organ is notched and uneven. It is about three or four inches thick along its palpable border; pressure does not cause pain.

On April 12 a report from the patient stated that he felt weaker; his appetite was fair, bowels regular, and that pressure symptoms on lying in bed were increasing. Standing and walking were becoming difficult because of the great weight of the spleen. All other symptoms remain unchanged.

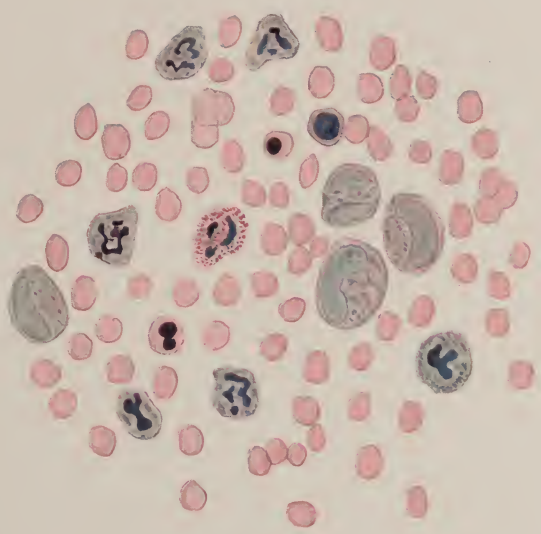
The quantity of urine voided in twenty-four hours was 760 cc., specific gravity 1,029, strongly acid; there was neither albumin nor sugar present, urea 2·9 per cent.; total quantity in twenty-four hours 21·4 grammes, uric acid 1·56 grammes in twenty-four hours, or 0·2 per cent.

Blood Examination.—The following table demonstrates clearly the characteristic changes found in the blood, with differential counts:—

Date	Red cells	White cells	Hæm. % (Gowers)	Differential Count.—Per Cent.							Remarks.
				Polymorphonuclear neutrophiles	Myelocytes	Lymphocytes	Eosinophiles	Basophiles	Transitional	Normoblasts	
Jan. 25	3,200,000	320,000	62	57	31	4·4	6·5	few	few	many	Many eosinophilic myelocytes and dwarf cells. Some microcytosis and poikilocytosis.
Mar. 10	3,280,000	132,000	62	52	38	4·1	5·7	few	few	many	A few megaloblasts, one 19 by 22 μ in diameter. Otherwise as above.
Mar. 17	3,300,000	162,000	64	57	34	4·2	4·7	many	few	many	Fewer normoblasts, but still plentiful. Many eosinophilic myelocytes.
Mar. 24	3,320,000	127,000	62	67	22	4·5	6	few	few	few	Marked microcytosis and poikilocytosis.
Mar. 31	3,200,000	124,000	58	69	16	6	3·5	4·5	few	very many	Nucleated reds in great numbers.
April 7	3,320,000	126,000	56	65	17	7·5	5·5	3	few	many	Red cells decidedly pale. Poikilocytosis marked.
April 16	2,922,000	121,500	55	68	17·5	6·5	5·2	very few	few	very many	Red cells pale. Numerous megaloblasts.

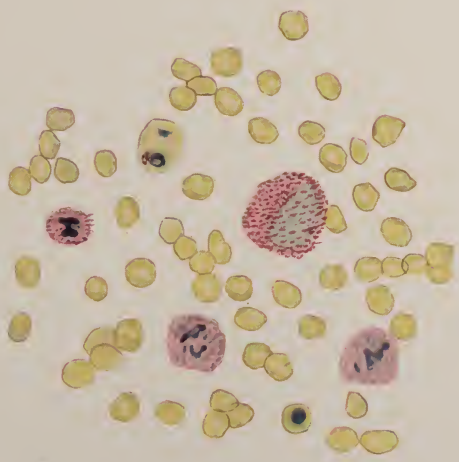
On December 31, 1899, the first blood examination was made. This examination is not included in the table which accompanies the paper, because no differential count of leucocytes was made. Dr. Larkin reported hæmoglobin 52 per cent., red count 3,286,000; leucocytes 320,000; colour index ·8. There was an increase in the polynuclear neutrophiles and myelocytes. Normoblasts were found; there were microcytosis, moderate macrocytosis and poikylocy-

Fig. 1.



Appearance of the Blood-film Stained with Eosin and Methylene-blue.

Fig. 2.



Appearance of the Blood-film Stained with Ehrlich's Triacid Mixture.

tosis. Another examination made February 9, 1900, not included in the table, showed hæmoglobin 49 per cent., 2,680,000 reds; 240,000 whites; colour index ·9 per cent. The gross microscopic find is the same as December 31, 1899.

The differential counts showing the enormous percentage of myelocytes brand the case as one of splenic-myelogenous leukæmia. The large number of myelocytes may be considered pathognomonic. The average of these in our case is 26 per cent. At one time, before the tuberculous process was far advanced, we found 38 per cent. There is a marked relative reduction in the number of lymphocytes, which vary in the counts from 4·1 per cent. to 7·5 per cent. The varieties blend; atypical and transitional forms are plentiful. The eosinophiles are increased actually and relatively. Many of these are myelocytes and dwarf cells.

This latter condition is frequently present in splenic myelogenous leukæmia, but it is not pathognomonic. The basophiles or "Mastzellen" of Ehrlich are plentiful, but this increase is neither characteristic, nor has it pathologic significance. The number and condition of the red cells is typical. The usual *mild* anæmia with slight changes in the size and shape of the erythrocytes is present. The count ranges between 2,922,000 and 3,320,000. The presence in the blood of large numbers of normoblasts, with occasional megaloblasts without the symptoms of grave anæmia, is characteristic of splenic myelogenous leukæmia, and is due to the involvement of the bone marrow. The percentage of the hæmoglobin is absolutely and relatively diminished. With the advance of the tuberculosis in our case the red cells change but little. In spite of increasing debility and great exhaustion there is practically no reduction in their number nor change in their condition. Relatively high counts are frequently made in advanced tuberculosis. The concentration of the blood resulting from excessive sweating and expectoration accounts for this condition (Cabot).[1]

We find a gradual and steady decrease in the total number of leucocytes, but an increase in the percentage of polymorphonuclear neutrophiles, a decrease in the number of myelocytes and an increase in the number of lymphocytes as the tuberculous process advances. The blood, however, retains all of the characteristics of splenic myelogenous leukæmia.

In connection with the study of the blood in this case, it is exceedingly interesting to note the changes which follow as the tuberculous process advances.

We have been able to find in medical literature four well authenticated cases of leukæmia with tuberculosis, which we shall consider later in this paper, the blood counts of which we shall consider at this point (Quincke,[2] Stintzing,[3] Lichtheim,[4] Baldwin[5]).

In the case of Quincke,[2] which was, in all probability, a case of mixed leukæmia of the splenic myelogenous and lymphatic varieties, acute miliary tuberculosis supervened. With increase of the tuberculous symptoms there was, as in our case, a marked reduction of characteristic leucocytes. With this reduction and disorganising processes in the lung, the spleen and liver enlargements receded materially.

In Stintzing's[3] case, which was, in all probability, one of lymphatic leukæmia associated with chronic tuberculosis, the blood at first showed moderate leukæmia (1 to 100) with a normal red count. With a progression of the tuberculosis and cavity formation at the apices and the presence of tubercle bacilli in the sputum, the leukæmia improved. The author says that the lymphatics were less enlarged and there was a positive reduction of leucocytes, the proportion changing materially (1 to 150).

Lichtheim's[4] case, which is mentioned by Baldwin,[5] is not of the splenic myelogenous variety with tuberculosis, but is of lymphatic character. In the report of this case Lichtheim presents a table which shows a marked reduction in the number of leucocytes as the tuberculosis progresses.

The first count made on November 22, 1896, showed 40 per cent. hæmoglobin ; 2,000,000 red corpuscles ; 250,000 whites ; the relative proportion of whites to reds 1 to 8. On December 28, 1896, the number of whites had fallen to 82,000, the reds increased to 2,800,000. On February 19 following, the count of the white corpuscles was 8,900, the reds had increased to 3,300,000. The proportion of white corpuscles to red, it will be noted, was changed with the advancing tuberculosis from 1 to 8, to a count showing one white corpuscle to 370 reds. Indeed, Lichtheim, in his article, makes the statement that at this time no one would have dreamed from a simple blood count that the patient had ever had leukæmia. In Lichtheim's case, with an advancing tuberculosis the spleen and lymphatic glands were much reduced in size.

Baldwin's[5] case of lymphatic leukæmia complicated with tuberculosis, recently reported, stands alone so far as we have been able to decide from the study of the literature at our command, in presenting full and repeated differential blood counts. The diagnosis was confirmed *post mortem*. Unfortunately there were no blood counts made early in the history of this case. The first examination reported was made on October 1, 1897, when 695,000 leucocytes and 3,010,000 red corpuscles were found (1 to $4\frac{1}{3}$). The last count was made December 9, 1897, and showed 959,500 leucocytes, 2,435,500 red corpuscles (1 to $2\frac{1}{2}$). The patient died on December 10, 1897, one day after the last count had been made. In this case, with an advancing tuberculosis there was a marked increase in the number of leucocytes, with a decrease in the number of erythrocytes.

The case which we report is the first of splenic myelogenous leukæmia with tuberculosis of which we have knowledge, from a study of the literature at our command, in which repeated differential counts have been made. Without these the true character of the leukæmia cannot be decided ; with them we can reach positive conclusions. In this belief we are supported by Muir[6] and Bramwell.[7]

We have been much interested in the study of the literature which relates to the changes which take place in leukæmic blood as the result of added infection. It may be assumed to be a fact, that with added infection of whatever nature, there is likely to be a marked reduction in the number of leucocytes.

Thus Eisenlohr[8] reports the case of a patient with splenic myelogenous leukæmia, who contracted typhoid fever. The added infection proved sufficient to reduce very markedly the number of leucocytes.

Heuck[9] reports a case of acute infection added to leukæmia, in which there was the same decided reduction of white cells.

Mueller,[10] in a case of leukæmia complicated with sepsis, found a reduction in the number of whites from 246,900 to 57,300. Kovac's[11] case of leukæmia, complicated with influenza, showed a change from 67,000 to 17,000 white corpuscles.

The very decided increase in the elimination of uric acid in our case deserves special mention. This, of course, is not surprising if we subscribe to the theory of Horbacyewski, which he has so graphically brought to the notice of the profession. In the study of this question we find the literature of the subject contradictory and unsatisfactory.

Thus in three cases reported by Laache,[12] von Noorden,[13] and Quincke,[14] where disease was associated with exceedingly low white counts, the quantity of uric acid in the urine was increased and was found to be 2·2 grammes, 1·6 grammes, and 1·8 grammes, respectively.

Levi,[15] in his exhaustive article makes this statement : "We are not to forget that the elimination of uric acid and its derivatives gives no exact clue to the quantity of the uric acid produced within the body. Too much honour is bestowed upon the leucocytes of the blood if we attribute to them alone the changed and increased elimination of uric acid in these cases."

Richter[16] thinks that our clinical and experimental experiences prove that the association of leucocytes and uric acid excretion cannot be ignored. But yet he says, "all factors considered, they are not sufficient, in the present state of our knowledge, to permit positive conclusions on this association."

A few words concerning the lung changes in leukæmia may not be out of place.

In Stengel's[17] exhaustive article on leukæmia, under the head of Respiratory Symptoms, we find the following statement: "Considerable involvement of the lungs themselves (Deiter's) may occur and the infiltrated areas may suffer necrosis and break down with the formation of cavities resembling those of tuberculosis (Boettcher)."

Reference to the original paper of Deiter,[18] shows that the author in considering this subject makes no mention of tuberculosis. He, as well as Birch-Hirschfeld,[19] mentions the occurrence of heteroplastic-lymphoma in the lung as being characteristic of leukæmia. Boettcher's[20] article quotes Ehrlich's[21] statistics given in his Inaugural Dissertation in 1862, in which ninety-eight cases of leukæmia were reported, in twelve of which he imagined that he found tuberculous complication. He does not state in how many of these the lung was involved, and from the fact that disorganising processes are not uncommon in leukæmic infiltrations and at that early day bacteriological determination was not practised, it seems to us that Boettcher[20] is justified in stating that "without wishing to deny the complication of the two processes, I am not satisfied that in those cases where pulmonary tuberculosis has been considered, the author has differentiated leukæmic disease of the lung and pulmonary tuberculosis." He says still further "in spite of the fact that *post-mortem* and microscopic experiences seemed to favour the diagnosis of tuberculosis, yet later it was found that this was not correct."

The lymphatic enlargements in the lung may undergo retrograde metamorphoses just as often happens with lymphatic growths in the intestine.

Virchow[22] calls attention to the small lymphoid masses in the pulmonary tissue, particularly in the respiratory mucosa associated with leukæmia. He has found these resembling tubercle, on the epiglottis, the aryepiglottic folds, at times reaching into the bronchi. He says "these resemble tubercle but are not true tubercle structures."

In Epstein's[23] exhaustive article, which includes sixteen *post-mortems*, in cases of acute leukæmia there was no mention of tuberculosis as a complication, nor were any suspicious lung changes found.

Bramwell[24] in his recent work on "Anæmia," and Hoffman,[25] in his "Constitutions Krankheiten," make no mention of the association of tuberculosis with leukæmia.

Muir[6] says: "In the lymphatic form of the disease the connective tissue of the lungs may be the seat of leucocytic infiltration. The walls of the bronchi and the peribronchial tissue are chiefly affected, and the condition may be diffused or localised so as to form thickenings. This change, which may be found only on microscopical examination, is of the same nature as that occurring in the connective tissue of other organs. On microscopic examination, also, many of the small vessels may be found plugged with leucocytic thrombi, and hæmorrhages may be seen around them. The lungs are generally œdematous, and various other conditions may be present as complications."

Unfortunately, the last sentence of this quotation is not sufficiently definite to justify the conclusion that the author has met tuberculosis of the lung associated with leukæmia.

It is very difficult in our case to decide whether there was a latent tuberculous deposit in the lung before the advent of leukæmia. The early history of the case, including the abdominal symptoms, the characteristic changes in the cellular elements of the blood after the positive evidences of advancing tuberculosis, lead us to believe that pulmonary tuberculosis was superadded, or if present and latent, did not become

active until a number of months after the beginning of the splenic myelogenous disease.

The case of Quincke,[2] to which we have already referred, was reported by him at the sixty-second annual meeting of the Association of German Scientists and Physicians in Heidelberg. Our study of the report of this case leads us to conclude that there was a mixed splenic myelogenous and lymphatic leukæmia in which true miliary tuberculosis supervened. In this case no differential counts are reported. We are somewhat confused by Quincke's statement that "in the place of leucocytes there were in the blood large masses of fine granular protoplasm and blood plaques." Possibly these "granular masses" were eosinophiles. The spleen and liver enlargement receded materially as the tuberculosis advanced.

At the same meeting Stintzing[3] reported an analogous case in which the tuberculous process was chronic. The patient, who was examined twelve months before, was found with enlarged glands, moderately enlarged spleen, and infiltrating disease of the right apex. The blood examination showed moderate leukæmia (1 to 100) with normal red counts. After six months pulmonary infiltration increased, disorganisation was progressive, cavity formation followed at the apices, and tubercle bacilli became plentiful in the sputum. Leukæmic symptoms improved with the advancing tuberculosis. Stintzing[3] reports this case to prove that chronic tuberculosis may materially influence the course of leukæmia.

Lichtheim's[4] case was one of lymphatic leukæmia with infiltrating tubercle. The patient was 26 years of age, a male, who twice during the two preceding years had suffered from intestinal disturbances with fever. Seven months before death there was epistaxis, and a splenic tumour was discoverable. The cervical glands were markedly enlarged. The history of the case leads us to conclude that tuberculosis

preceded leukæmia. In this case, as we have already mentioned, there was a marked reduction of the leucocytes as the disease advanced. There is no record of a differential count.

Baldwin's[5] case was one of lymphatic leukæmia with tuberculosis. The *post-mortem* examination revealed characteristic lesions. Baldwin was fortunate in obtaining *post-mortem* evidence of the correctness of his diagnosis, as tubercle bacilli were never discovered in the sputum.

Weidner's[26] case, which has been suspected to have been one of splenic myelogenous leukæmia complicated with tuberculosis (Baldwin[5]), cannot be considered in connection with these positive cases, in spite of the fact that the *post-mortem* showed enlarged and caseous retro-peritoneal and mesenteric glands. In this case the lungs were found normal. No microscopic or bacteriologic examinations of the caseous glands were made.

We have felt justified in reporting our case as one of tuberculosis associated with splenic myelogenous leukæmia, because of the physical signs referable to the lung, spleen and liver, the laryngeal ulceration, the presence of tubercle bacilli in the sputum, the pathognomonic changes in the cellular elements of the blood, and the convincing differential counts.

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PETROLEUM IN THE TREATMENT OF PHTHISIS.

BY DR. WILLIAM DUFFIELD ROBINSON.

PHILADELPHIA.

CRUDE petroleum, as yielded by Pennsylvania wells and most other sources, is a liquid oil of specific gravity of ·86 to 77, of strong offensive odour, and colour ranging from light yellow to greenish black. It consists of many hydro-carbons of vastly different volatility and specific gravity. They are separated by fractional distillation. A temperature of 800 Fahr. is attained before the last volatile parts distil over. Crude petroleum yields of gasoline 1½ per cent., purified naphtha 10 per cent., petroleum benzine 4 per cent., kerosene 55 per cent., lubricating oils 17½ per cent., paraffin wax 2 per cent., loss, gas and coke 10 per cent.

Each fractional distillate is purified by agitation with sulphuric acid by means of an air blast. After subsidence and separation it is washed with water, agitated with alkali and again washed.

That which remains after kerosene, and all the more volatile parts are removed, is what interests us. It includes the paraffin oils, or so called amorphous paraffins, the soft, fat-like substances officially named petrolatum molle, and petrolatum spisse. The paraffin oils are still further refined by heating with animal charcoal and repeated filtration through this or purified dehydrated clay. Any paraffin wax in solution is removed after separation by sub-zero temperature. The oil resulting from this treatment is a much greater refinement of the officinal oleum petrolatum. It is absolutely odourless, colourless and tasteless, and non-iridescent or fluorescent.

A form known as terraline by the refiners is a semi-solid, of yellowish opaque colour, and slight odour and taste. It contains some paraffin wax and has not had full charcoal treatment. That containing a little more wax is petrolatum molle, or the cosmoline and vaseline of commerce. In 1885, Drs. Samuel G. Dixon and N. Archer Randolph published the results of their experiments with the administration of vaseline. From four to eight drachms were given daily. Every grain was reclaimed, unchanged, from the stools, save minute loss attributable to loss in separating and purifying. In the London letter to the *Medical News* of April 22, 1899, there was published observation of the same results after the administration of terraline. This corroborated Dixon and Randolph. My own study has been made mostly with the most perfectly refined product, the colourless, odourless oil, before mentioned. That every minim swallowed passed entirely through the intestinal tract of man unchanged was repeatedly proven. It was argued by the English writer that, since all could be reclaimed from the fæces, it therefore could have no therapeutic effect, other than simply lubricating the intestines and so making bowel movements easy. Reliance on securing any other result was vigorously discouraged. It can be assuredly asserted that the effect of the administration of these petroleum products is decided, and is far more than a simple intestinal lubricant. In over fifty cases selected during the past four years, where nutrition, digestion, and body weight were impaired, and the purest oil administered in one or two-drachm doses, four times a day, for periods of from three to six months, there was in every instance increase in weight and improvement in health, strength and feeling of well being.

The gain in weight was $5\frac{1}{4}$ to $23\frac{1}{2}$ lbs. There was no other change in living conditions or medication, which might have caused these improvements. It gave no discomfort in any instance, as it is absolutely indigestible, and unchangable in the intestinal tract, and so no ill of any kind resulted. Nature

evidently made no effort towards its digestion or assimilation. In passing of gall stones I have given nearly a pint in a few hours. Its action must be purely mechanical and solvent. By its constant and diffused presence in the intestines, the environment for micro-organisms was necessarily changed and the adaptability for their growth lessened. Fermentive and putrescent changes were controlled, and normal functions along the entire tract were re-established. The intestinal toxines were not formed, or if some developed, they were dissolved by the petroleum and so carried off. Indican and etherial sulphates disappeared from the urine. There is little, if any, doubt, but that its germicidal effect is purely mechanical. Each micro-organism, of necessity, is dependent for its existence on the freedom and integrity of its avenues for taking in air and nourishment. Should these avenues be mechanically closed by petroleum oil, possessed of its peculiar qualities, the micro-organisms must of necessity die of starvation and suffocation. If it is possible to control the pathogenic micro-organisms of the intestinal tract by such innocuous mechanical means, a valuable addition will have been made to the treatment of chronic bronchitis, incipient and actively established phthisis.

The elimination of pathogenic germs and their products by this benign mechanical means from the intestines secures the conserving of nature's potent forces for undivided defence against disease activity in the bronchi and lungs. A close study of the results of its use indicates that it accomplishes all secured from cod-liver oil, and is wholly free from the many objections characterising that unstable animal oil. The action known as alterative seems to be equally as well secured by petroleum as by cod-liver oil. As nature always makes a more or less successful effort toward the cure of those diseases where an alterative is indicated, and as these same conditions are nearly all associated with disease, disorder, or functional inactivity in the intestines, the elimination of the latter con-

ditions means undivided, and so stronger and more certainly victorious efforts in mastering disease activity in other organs. Chemical intestinal bactericides are all more or less absorbed, and the tax of their elimination is an added embarrassment. Nearly all are dissipated long before the entire course of the intestine has been traversed, thus differing from petroleum. Petroleum also possesses the valuable property of being an ideal solvent and dilutant for many remedies popular in the treatment of phthisis, such as creosote, the fixed oils, and nearly all volatile oils and alkaloids, and many chemicals. When this oil is used hypodermically and under antiseptic precautions, no inflammation results and it speedily disappears, no physiological action being so far recognised. Theoretically it should be ideal as a fluid for compression of lung by intra-pleural injection. I know of no other substance of its approximate properties but what is chemically changeable and may be a food for animal and vegetable life. Many remedies, whose therapeutic effects are brought about by constitutional impression after absorption, have the quality of objectionable local irritant action when undiluted. The usual solvents and dilutants have decided effects not indicated or desired, namely, alcohol in various strengths, glycerin, volatile and fixed oils and fats, that may become rancid and are of difficult digestion. In many instances pure petroleum oil may replace such solvents, as it offers scarcely more objections than pure water. I have extensively given from five to ten grains of salol in two drachms of this oil four times a day, and reclaimed the oil from the fæces and found it to contain some salol, and its components phenic and salicylic acids. This proves the carrying of a chemical antiseptic and anti-ferment through the entire canal. Phosphorus may be dissolved in it for hypodermic administration. It is solvent for iodine, sulphur, beta, naphthol, naphthaline, menthol, thymol, camphor and iodoform. Oleic acid and oleates are soluble. By the addition of a little ether, chloroform, or

oleic acid, the field of its power to dissolve is greatly increased, and includes many of the alkaloids. There is no evidence indicating that that which is removed from crude petroleum in refining has any medicinal virtue. Its range of usefulness as an assistance in combating phthisis is plainly apparent, both by its almost unique mechanical action and in association with other remedies. It is the best medium for the conveyance of remedies by nebulisation to the throat and bronchial tubes. It is the ideal remedy for the cure of all forms of constipation, and for treatment of tubercular infantile diarrhœa and *petit-mal* epilepsy from intestinal cause. The commercial offerings of petroleum in forms for internal use are not many.

DISCUSSION.

Dr. NEWTON: The fact mentioned by Dr. Robinson that nearly the entire amount of certain drugs taken by the mouth may be recovered from the fæces cannot be considered an argument against their use. I have been told that doses of morphine and quinine can be nearly all recovered from the urine.

STAMINA: WITH SPECIAL REFERENCE TO THE CONSUMPTION OF FAT FOOD FOR ITS MAINTENANCE AND AS A PREVENTIVE OF TUBERCULOSIS.

BY A. N. BELL, A.M., M.D.

WHILE every observer recognises the progress that has been made during recent years in the prevention of, and the reduction of mortality from, tuberculosis, by dealing with unsanitary surroundings, the establishment of sanitaria, changes of climate, &c., it seems to me that no one who even approximately comprehends the universality of microbic life—and of none more than tubercle bacilli—can fail to perceive that, however much we may be able to modify the external relations bearing upon liability to tuberculosis, nevertheless every individual, no matter where his dwelling place, is more or less subject to tubercle bacilli; for, besides the utmost restriction of their prevalence by human effort, unless the individual is possessed of an organism sufficiently fortified to resist and overcome conflict with them—for the conflict is certain everywhere—he is liable to contract tuberculosis. Indeed, every predisposing cause of disease is a challenge to one's power of resistance. Every intelligent person knows that the power of resisting the ordinary exciting causes of illness, such as sudden changes of temperature, exposure to damp soil, room or sheets, or night air with the windows closed, depends upon one's state of health. The power of resisting microbes as an exciting cause of disease is no exception.

Health fortified by such conditions as the organism depends

upon for its fabrication and maintenance opposes itself to all exciting causes of disease by the relative integrity, strength and vigour of all the organs and functions of the body. A person thus equipped, if beset by tubercle bacilli or other microbes, effectually resists them, devours them by oxidation and casts them off.

Feebleness, on the contrary, though not always appreciated and sometimes cultivated, indeed, by the practice of that altogether too popular fad, abstemiousness, is always and everywhere a prevailing "predisposition" to disease; and, associated as it commonly is with inadequate nourishment, it is the most frequent of all incitants to tuberculosis. Abstemiousness, however, is variable in its practice, and uncertain; one may over-eat and yet abstain from some essential food necessary for the maintenance of health. Adequate nourishment and stamina depend upon the supply of nutriment in the kinds and proportions required by our bodies.

By a somewhat extended observation and careful study of the relation of tuberculosis to food, I have come to the conclusion, which it is the purpose of this essay to vindicate, that, other conditions being equal, tubercular diseases are prevalent in the inverse ratio to the use of fat of some kind as an article of diet.

Antecedently, in persons on the verge of pulmonary consumption, inability to digest fat food is one of the most prominent symptoms. They are afflicted with dyspepsia, of the kind in which an acid stomach is predominant—that kind of dyspepsia which is the common effect of the excessive and too exclusive use of farinaceous food; insomuch as, in some cases, to have created a loathing of fat food in every form. Nevertheless, in medical practice generally, this condition is an indication for the use of fat food. Cod-liver oil, emulsified or otherwise, is almost universally the first remedy resorted to and the most persistently urged. Butter or bacon, the most digestible of all fat foods, I have often found to be more

acceptable. Fat is the needful thing to energise both digestion and nutrition. And that form of it which is the most acceptable is the best.

In this relation I am reminded of a conversation on the subject with an old naval colleague, the late Dr. Richard McSherry, of Baltimore, some thirty odd years ago. He related a case then but recently under his care, in substance as follows :—

A much emaciated German shoemaker, with pronounced phthisis and a particularly rebellious stomach, had been an office patient for several months. He had tried various ways to render cod-liver oil acceptable, but with discouraging results. The patient was evidently losing ground and the intervals between his calls increased until they had ceased altogether ; his condition was such, at his last call, as to leave but one inference. About two years had elapsed, when, on responding to an early morning call and going to his office, he faced a full-bearded and healthy-looking man, who accosted him familiarly, and then, checking himself, said, "Doctor, you seem to forget me. Don't you remember the old half-dead patient that you tried to feed wid cod-liver oil two years ago ?" He did remember, and he said to me that he was never more astonished in his life—he could hardly believe his senses. And before hearing the purpose of his old patient's call he pressed him to tell where he had been and what he had done—what treatment he had been under—to account for the wonderful change in his condition. He replied briefly, because he was in a hurry : "Vell, when I couldn't call on you no more a countryman of mine tole me that he was wunst jist as bad as I vas, and somebody tole him to take dog fat. So I kill my dog and fried out his fat and went taking it. I been taking dog fat mos ever sence —doctor, won't you please go see my wife ; she's goin' to have a baby."

It was only the fat.

I would be second to none in my appreciation of the success that has attended the efforts of sanitarians and others, in England and elsewhere, for the prevention of tuberculosis, before, as well as since Koch's immortal discovery of the tubercle bacillus; nor of my appreciation of the benefit of change of climate, or resort to an ocean atmosphere as means of lessening the susceptibility to and treatment of, and reducing the mortality from, tuberculosis. But for the prevention of the disease, none of these means, nor all of them together are, in my judgment, comparable with the benefit derivable from a generous supply of fat in the dietary.

As regards the general history and geographical distribution of tuberculosis, its prevalence, more or less, is contemporary with mankind everywhere. The number of localities throughout the world alleged to be exempt from it is so small as to justify the conclusion that no place inhabitable by man is exempt, that tubercle baccilli are universally distributed. They are proportionately active with the prevalence of conditions favourable to their reception and tolerance, and the deficient power of man's resistance. The accessory conditions are, in general, density of population, foul soil, foul air, deficient sunlight and exclusion of fat food. Diminution of the prevalence of tuberculosis by the amelioration of these conditions, though very great—about 50 per cent. in England and Wales alone—during the last fifty years, is on a par with the reduction of the prevalence of other diseases.

Some writers are wont to refer to Iceland and some other arctic and sub-arctic regions, whose inhabitants rarely or never have consumption, though they commonly sleep in stifling huts, reeking with offensive emanations, that are but rarely or never cleaned. Furthermore, the denizens of such huts at night habitually expose themselves in the daytime to the worst possible conditions of weather. Their exemption from tuberculosis is commonly attributed to the extreme

cold of such regions, and the erroneous inference drawn that outdoor exposure in frigid climates is commendable for consumption.

The food of these exempt communities is almost wholly of an animal character, the fattest portions, and "toodnoo," a kind of butter made of the separated fat of reindeer, of which they eat enormous amounts.

Moreover, besides their power of resistance to the tubercle bacillus, the Esquimaux and other inhabitants of the arctic regions who live on such food are possessed of gigantic muscular powers. They are able to lift and carry burdens twice as heavy as those which the seamen visiting them are able to carry.

In similar regions where the inhabitants or immigrants do not consume much fat food, tuberculosis is no less, indeed, among some of them it is much more rife than it is among communities in temperate latitudes.

Fat, as an article of diet, furnishes the potential force necessary for the conversion of other food material into organic tissue and to maintain the bodily functions.

Professor W. O. Atwater, in one of his most recent contributions to the Department of Agriculture,[1] on the nutritive value of foods, in comparing nutrients in respect to their fuel values, their capacities for yielding heat and mechanical power, states that "a pound of protein lean meat or albumen of egg is just about equivalent to a pound of sugar or starch, and a little over two pounds of either would be required to equal one pound of the fat of meat or butter."

The mistake commonly made with reference to the use of fat food is, that it is only, or especially applicable in cold climates—an erroneous inference, the same as that that cold is preventive of tuberculosis. That fat is the almost exclusive food in arctic regions is because other food is not obtainable,

[1] *Farmer's Bulletin*, No. 23, 1894.

not because of the frigid climate. It is necessary food, though not in such excess, at all times and everywhere, to supply the potential energy required by the organism to construct the tissues and maintain the body, the temperature of the body being about the same in all climates. Fat does not stand alone in this regard, except under such extraordinary circumstances as those referred to. Carbohydrates of various kinds contribute to the same functions as fat, under ordinary conditions, but they do not suffice to maintain the stamina of the organism to the highest degree anywhere without the assistance of, or being supplemented by, some kind of fat.

A correct appreciation of the benefit of fat food in the arctic regions serves as an index to its advantages under other conditions. It is not limited to blubber, "toodnoo" or oil, even among the Laplanders. It includes the solid portions of reindeer, seal and other meat. And this in its composition doubtless compares favourably with the choicest cuts of beef and mutton, which consist of from 20 to 30 per cent. of fat; or possibly with good bacon or ham, about 35 to 50 per cent. Good butter, it hardly need be said, is almost wholly fat—85 to 90 per cent.

Of approximate stamina and exemption from tuberculosis, it is not far-fetched to refer to the history of most of the North American Indians, before the cultivation of cereals was introduced by the white settlers. Their food was almost exclusively the fat game which they hunted and killed in such a manner as to retain the blood. Of the wonderful physical strength and endurance of those savages, the history of them furnishes many examples. And the earliest records of consumption among them are contemporary with the attempted methods of civilising them—inducing them to leave their tents and live in houses; restricting their game supply and supplying them with farinaceous food. They have ceased to be a hardy race and tuberculosis is common among them. The Gauchos of the South American pampas live almost exclusively upon fat

animal food, are alike remarkable for their extraordinary stamina. The flesh-eating Mahometans of India are described by historians as being the most powerful, active-minded and hardy race of human beings in the world, presenting the widest possible contrast in physical development to the rice-eating and feeble Hindoos, of whom but few reach the age of 40.

A striking example of what appears to be the result of a change from an almost exclusive fat meat diet to one largely farinaceous, in relation with tuberculosis, is afforded by the history of the New Zealanders, who, until about fifty years ago, were cannibals, eating their captives in war, but who besides consumed an enormous amount of fat pork. Dogs also composed a part of their dietary, and fish to some extent. They were remarkable for their physical development and exemption from tubercular diseases. But soon after the introduction of the potato as a staple food, at about the time mentioned, scrofula and other forms of tuberculosis began to prevail among them, and have attained a degree of prevalence even greater than among the poorest people in Ireland, where the staple food is of the same kind, but beneficially supplemented to a considerable extent by the use of buttermilk.

Moreover, I have observed among people in the tropics, as well as in temperate latitudes, that there is a marked difference in the health of persons, whose chief food is farinaceous, between those who but rarely eat anything else and are particularly feeble, lymphatic and scrofulous; and those who eat butter or oil with their rice and similar food, or supplement it with sardines in oil, or oil-dressed salads.

Recurring to what I have remarked on the superiority of meat that retains the blood as well as the fat, every epicure knows and every physician ought to know, that the meat of animals of every kind so killed as to retain the blood is more delicious than that of animals otherwise killed. It is also more digestible and more nutritious.

All fresh meat is more or less acid, and that from which the blood has been drained requires to be kept until alkalinity is induced by incipient decomposition before it becomes tender and digestible. On the contrary, that which retains the blood only requires thorough cooling before it is ready for cooking and is tender and digestible from the outset, because the alkalinity of the blood speedily acts upon and neutralises the acid. Hence, the meat of the buffalo, as it used to be killed and prepared by the North American Indians; the jerked beef of the Gauchos; the beef of cattle that have been knocked in the head, or preferably, by dividing the spinal marrow in the neck, as now practised in the abattoirs of Chicago (if it is not afterward drained of its blood), is greatly superior to that which is prepared after the method of the Jews. Besides, the draining or soaking away the blood from meat impairs its nutritive value. The blood is essentially of the same composition as the flesh, but besides, it holds in solution phosphates of soda, salts of potash, iron and sulphates; all nutritives of vital importance to the human economy. But there is no method of slaughtering animals that entirely divests the flesh of blood, hence to attempt to prohibit eating it to be effective should prohibit the eating of meat altogether.

While this note was in process came a press announcement that "tuberculosis has increased more than 80 per cent. in certain districts of Norway within the last thirty years, and this despite the invigorating cold of the Norwegian clime and the hardy physique of the Norwegian people. Statistics also show a steady gain in the number of deaths from consumption in Sweden, Russia and northern countries generally."

If there is truth in this publication, it will or may be accounted for, I think, by too exclusive use of farinaceous foods.

Relative exemption from tuberculosis, under all circumstances, is, according to my observation, due to the generous use and potentiality of fat food.

My conclusion in this regard is fortified by many years' observation and study of the liability to consumption of peoples collectively, families and individuals, more or less proportional to their abstinence from fat foods: the most prominent example of whom I have never lost sight of from my youth up—the negro race in America.

I began my professional life among them when they were slaves and were always supplied with an abundance of "hog and hominy," not by any means restricted to these articles, but pork or bacon was a standing portion of at least one daily meal. Consumption among them was relatively rare.

My observation in this respect was not singular but in accord with all other medical observers of the time of whom I have knowledge. Conversely, it seems hardly necessary to invite attention to the prevalence of consumption among the same people now, under their changed conditions with regard to diet. "Hog," at least, is notable by its absence from the daily fare of most of them and no other fat meat has taken its place; and consumption among them is more than twice as great as it was formerly.

The same observation extends to smaller communities, families and individuals. Consumption is most prevalent among those who are stinted or who stint themselves of "bacon" and "butter." I mention these as ideal and, as before remarked, because they are the most digestible of fat foods; other fat foods are commendable.

Everybody has learned, when it is unfortunately, in most cases, too late, that cod-liver oil is good for consumptives, but few seem to have learned that food of the same character as cod-liver oil, suitable for the table, is preventive of consumption.

In the whole course of my professional observation, now covering a period of nearly sixty years, I have known but rarely a family or an individual that was brought up on a liberal supply of butter and bacon who became tuberculous.

Moreover, such food fortifies the system against other diseases as well as consumption ; it establishes stamina.

DISCUSSION.

Dr. JUDSON DALAND : If I understood Dr. Bell correctly, I believe he stated that the reason why the Icelanders did not acquire tuberculosis was that they consumed large quantities of fat. I have seen something of these people, and I know that tuberculosis has made rapid inroads among them in recent years. The only reason I could learn for this was the introduction of tuberculous material from Denmark.

Dr. SOLLY : I am glad to endorse what Dr. Bell said about the dietetic value of butter and bacon. The paradox is true—if you eat your bacon, you will save it.

Dr. BELL, replying to Dr. Daland : What I have said with reference to the cause of the recent increase of tuberculosis in Norway, is probably equally applicable in Iceland.

SOME THOUGHTS ON THE NERVOUS SYSTEM IN PULMONARY PHTHISIS AS A BASIS FOR TREATMENT.

BY THOMAS J. MAYS, A.M., M.D.

PHILADELPHIA.

If one fact is more apparent than another it is that pulmonary phthisis is neither primarily nor throughout its course a disease of the lungs exclusively. More correctly defined, it is an exhaustion of the vital forces of the body in which loss of appetite, fever, night-sweats, quick pulse and respiration, loss of flesh, tiredness, sleeplessness and nervousness either accompany or precede the earliest implication of the pulmonary organs. If pulmonary phthisis is not essentially a disease of the lungs, what texture of the body is primarily at fault? From as conscientious and careful a study as I have been able to give to this subject, I believe that the original trouble in the great majority of cases lies in the brain and nervous system, and particularly in the pneumogastric nerves. These nerves, besides supplying the lungs, innervate the external ear and tympanum, pharynx, uvula and soft palate, œsophagus, larynx, heart, stomach, intestines, liver, spleen, kidneys and supra-renal capsules—all organs of the most vital import to the human economy. The chief function of these nerves is that of establishing a close and intimate relationship between these organs, and, indeed, it may be said that this influence extends over the growth and repair of every texture, for Gaskill holds that the sympathetic nerves are in large part but a continuation of the vagi.

Now, it will be admitted as a fundamental fact, I think,

that if, from any cause, a nerve supplying an organ, or a number of organs, becomes impaired, the integrity of the latter suffer both in function and in structure. That the vagi are thus primarily involved in phthisis I have shown in rather a large collection of cases in which the confirmation was made by *post-mortem* examination. These cases demonstrate (1) that phthisis follows the pressure of tumours, or of aneurism on these nerves; (2) that diseases of the brain and nervous system, as insanity, idiocy, epilepsy, asthma, hysteria, diabetes, locomotor-ataxia, &c., are, in the majority of such cases, followed by phthisis in which the vagi are frequently involved; and (3) that poisons of the brain and nervous system, like alcohol, syphilis, mercury, lead, typhoid fever, diphtheria, whooping cough, &c., are frequently causative of phthisis, or of some other form of pulmonary disintegration in which the vagi are implicated. From these facts we may therefore conclude that any condition, or agent, or influence that seriously impairs the vitality of the brain or nervous system also impairs the integrity of the vagi and leads to phthisis or of some other form of lung disorder. On the score of this hypothesis we can account for the many important organs which are simultaneously involved in this disease; why there is ear disease, such as pain and perforation; why there is pain along the course of one or both vagi in the region of the neck; why there are pharyngitis, laryngitis, rapid heart-action, indigestion, intestinal derangements, diseases of the liver, kidney, spleen, &c.

Believing, therefore, that a rational therapeusis of pulmonary phthisis naturally rests on a nervous pathology in the large majority of those we meet in daily practice, I have for a number of years discarded creasote, guaiacol, benzozol, iodoform, ichthyol, thymol, rectal injections of sulphuretted hydrogen, and injections of other gases and serums from my armamentarium, and have employed measures which make a strong stimulating appeal to the nervous system. Among

these are strychnine, static electricity, quinine, capsicum, &c., and more recently I began giving attention to the local treatment of the vagi in the neck, first by massaging and kneading them through the overlying texture, which, although insufficient, I found a benfit to the cough and expectoration; and second, by engendering a certain amount of counter-irritation along their course by the subcutaneous introduction of a small amount of silver nitrate (5 mm. of a $2\frac{1}{2}$ per cent. solution) preceded by a similar dose of a cocaine solution—the latter being used for the purpose of obviating the pain which would be occasioned by the former. The point selected for the introduction of these agents is immediately over or slightly behind the pulsating carotid artery in the neck between the angle of the lower jaw and the clavicle. It is important to lift the skin between the thumb and forefinger of the left hand and introduce the needle just through the skin. After the cocaine solution is injected, detach the syringe from the needle and let the latter remain in the puncture. Wash out the syringe with water, draw the silver solution into the syringe, attach the latter to the needle and throw in the required amount. As a rule, the first injection should be given on the side of the neck on which the affected lung is located. In a week or ten days this is to be repeated on the opposite side unless the original or previous injection is followed by too much irritation. Some cases do well when an injection is given on each side at the same time. They should be given every week or ten days, and, so far as my records show, thirty was the highest number of injections I gave to one patient.

The local visible effects of the injections show themselves in nodular, sometimes in diffuse, swellings, and in redness and pain, but in no instance have these conditions become extremely pronounced. Small abscesses occur occasionally, but on the whole I think they are not harmful, and may be of benefit, inasmuch as they prolong the desired counter-irritation.

During the last nineteen months I have used the silver-nitrate injections in about two hundred cases of phthisis,[1] and the following deductions show their influences on the various clinical symptoms of this disease :—

Cough and Expectoration.—These injections were originally undertaken solely with a view of relieving the cough and expectoration, and there was no disappointment in this respect, for with but few exceptions these symptoms improved in a striking manner, and in some instances they ceased almost entirely after the first few injections. This was obtained chiefly among incipient and advanced cases, but was not without effect even in the far advanced cases. Besides their influence on the cough and expectoration they also ameliorated dyspnœa and oppression of the chest, this probably being well brought out in the alleviation which they give to the symptoms of asthma.

Vomiting.—Vomiting, which is one of the most annoying features of phthisis, was frequently relieved.

Appetite.—In the incipient and advanced cases the appetite, as a rule, is increased, and sometimes to a remarkable degree. This was also true in some of the far-advanced instances.

General Strength.—An improvement of bodily strength was noticed in most of the cases. Whether this was due to an increased power of eating or to some other influence is not easy to say, but the fact forced itself too often on one's attention to escape notice.

Physical Signs.—In many of the incipient, in some of the advanced, and in a few of the far advanced cases a marked improvement occurred in the physical signs.

Fever.—A decline in temperature frequently occurred

[1] (1) *Incipient* cases with beginning physical signs, some emaciation, cough, expectoration.

(2) *Advanced* cases without excavation, but with emaciation, cough, expectoration, &c.

(3) *Far Advanced:* excavation, with marked emaciation, cough, expectoration, &c.

in those cases in which the temperature could be taken regularly.

Night Sweats and Chills.—In a number of cases these symptoms abated.

Weight.—One of the most surprising results of this treatment was the increase of weight which occurred in many of the cases. This was not due to any other influences, for in my early experiments with this method I gave either no medicine or a placebo, and maintained the same conditions in regard to food, &c., during the treatment as those which existed before it. While the gain was principally confined to incipient and advanced cases, it was also seen to some extent in the far advanced cases. Among those who gained the following are good examples: One patient gained 5 lbs. the first week after the injections were begun, 6 lbs. the second, 4 lbs. the third, and 3 lbs. the fourth week. Another one lost 1 lb. in two days immediately preceding the first injection, gained 1 lb. first week after injection, 4 lbs. second week, 3 lbs. the third week, and 4 lbs. the fourth week. Another one lost 3 lbs. in five days immediately preceding the first injection, gained 2 lbs. during first week, 3 lbs. the second week, 2 lbs. the third week, and 4 lbs. the fourth week. Another lost 1 lb. in the week previous to first injection, gained 3 lbs. during week following, 4 lbs. in second week, and 2 lbs. in third week. Another gained 7 lbs. in six days after first injection, 3 lbs. in second week, and 2 lbs. the third week.

In conclusion, I believe that if this auxiliary method is combined with other good hygienic, dietetic, and medicinal treatment, the practical results will be greater than those represented above. Moreover, it seems to enforce on our attention the fact that the nervous system is the principal avenue through which pulmonary phthisis may be successfully approached from a therapeutic standpoint.

A CASE OF MURAL ENDOCARDITIS.

BY HAROLD WILLIAMS, M.D.

BOSTON.

WITH PATHOLOGICAL REPORT.

BY J. LEARY, M.D.

BOSTON.

THE following case is reported because of the rarity of the pathological lesion and because of the absence of murmurs, in spite of the extensive disease of the mitral valve.

The patient, a lady, rather inclined to obesity, aged 54, the wife of a physician, was cared for by her husband; by Dr. R. H. Fitz, who saw her once or twice a week throughout her entire illness, and by me. The autopsy was made by Dr. Leary.

The first symptom began on December 22, when after a short walk, she was seized with an attack of angina pectoris, with dyspnœa, and with pain. She with difficulty reached her house and was put to bed, where she remained until her death, March 15. I first saw her on the evening of February 9. On this occasion she was in a condition of collapse, occurring after one of the attacks of dyspnœa, from which she had suffered at intervals since December. This collapse was almost complete, the face was ashen; the temperature subnormal; the body bathed in sweat. No pulse could be felt at the wrist. The heart sounds were faintly audible. She was breathing in short gasps. She was having ether by inhalation. A subcutaneous injection of morphia was given and reaction set in. On the following day a careful physical

examination of the chest was made, as follows : patient was lying on her left side, her breathing was shallow and laboured, but no orthopnœa ; there was retraction of intercostal spaces and also of interclavicular space. Percussion : flatness of both sides of chest below sixth rib behind. Dulness over lower lobe of left lung. Auscultation : numerous sonorous and sibilant râles over entire back, subcrepitant râles over area of dulness at the left lower base.

Heart : action feeble, apex pulsation not visible, no abnormal pulsation ; no thrills. Percussion : cardiac area of dulness enlarged slightly to left. Auscultation : heart sounds feeble, rhythm disturbed, no murmurs, no accentuation of pulmonic second sound.

The subsequent history of the case was a history of frequently occurring attacks of dyspnœa. The subsequent attacks were always without pain, and nearly always were predicted by patient. They began usually with a quickening of the pulse which soon became trigeminal and weaker and weaker, until it was lost at the wrist. The dyspnœa was intense. It consisted of a rapid series of gasps accompanied by a rhythmical movement of the right arm. Consciousness was retained throughout the attack. The suffering in these attacks was intense ; they were precipitated by the least movement ; by any attempt at examination of the chest ; by conversation ; by the most trifling emotional causes. They were but slightly amenable to the usual remedies, each drug relieving for a limited time, as if the reserve force aroused by its especial agency was quickly exhausted. Finally the attacks became almost continuous ; the decubitus changed from the left to the right side and the patient succumbed March 15. At no time were murmurs detected by any of the physicians in attendance.

The apprehension of the patient and the supervention of paroxysms of dyspnœa upon the least change of position greatly interfered with examination, but the diagnosis was

made as follows : fatty heart with sclerosis of coronary arteries; hypostatic pneumonia lower lobe of left lung ; hydrothorax.

Autopsy.—The description of lesions in organs other than heart, the arteries and lungs is purposely omitted. The changes in other tissues were all dependent upon the cardiac lesion, and were in no way remarkable.

Left pleural cavity contains a large amount of clear serous fluid. Lung everywhere compressed, particularly lower lobe, whose tissue is dense and contains no air.

In upper anterior portion of lower lobe is a dark red wedge-shaped area of consolidation with its base 2 cm. in diameter on the pleura. At its apex was found a firm red clot filling a branch of pulmonary artery.

Right pleural cavity contains a smaller amount of fluid, and lung shows no gross signs of compression. In upper lobe of lung is a consolidated area, which occupies the greater part of upper portion of lobe. This area is discoloured dark blue and projects above surrounding lung substance. On section, lung shows a diffuse, very firm consolidation. Cut surface is bluish black and much blood may be scraped from it. At apex of consolidated area is found a long, firm, red clot, plugging one of the primary divisions of the branch of pulmonary artery supplying the lobe.

Sections of left lung show œdema and compression of alveoli. Some evidences of chronic passive congestion are shown by alveolar epithelial cells containing pigment granules, although the vessels of the alveolar walls do not in most cases contain blood.

Sections of right lung at base show a condition of marked chronic passive congestion with broncho-pneumonia.

No adhesions in either pleural cavity.

Pericardium contains no fluid ; surface smooth.

Heart 405 grammes (normal 250), found in diastole. All cavities dilated contain recent clots and fluid blood.

Heart muscle dark ; cut surface dull.

Left ventricle, the mitral orifice measured 10·5 cm. (Normal 10·4 cm.) Valve flaps show slight diffuse thickening. The chordæ tendineæ were generally thickened and shortened, in such a manner as to absolutely preclude closure of the valve. The papillary muscles are thickened and opaque at their apices, and several of the chordæ tendineæ are inter-adherent. Attempts to fold back the walls of the ventricle in order to inspect the interior, met with considerable resistance, on account of the tension of mitral segments. The endocardial surface of ventricular wall over triangular area, having for its base the posterior flap of the mitral and bounded by lines converging to the apex, is thickened, white and very opaque. On section into muscle, a superficial layer, varying in thickness from ·1 to ·3 cm., white, firm and fibrous, could be readily moved about on the underlying muscle substance, to which it was united by loose attachments. This layer, in places, includes half the thickness of heart wall. In the lower portion of this area are two small, firm, dry, dull white clots, which are attached to the endocardium, filling folds between the columnæ.

Elsewhere the endocardium is translucent and its outline cannot be distinguished on section of muscle.

Ventricular wall. Left ventricle, ·8 to 1·3 cm. in thickness (normal 1·1 to 1·4). Under area of endocarditis varies from ·4 to ·6 cm.

Right ventricle dilated. Tricuspid orifice 12·5 cm. (normal 12 cm.). Walls ·2 to ·4 cm. thick (normal ·5 to ·7 ?) Endocardium smooth, translucent. Valves show nothing abnormal.

Both auricles dilated and walls thickened. In right auricle are two old red clots in the folds of the pectinate muscle.

The left coronary shows nodular projections, throughout its course. Some of the areas are opaque, but none show calcification.

The lumen of the right coronary at about 2·5 cm. from

its origin shows a sudden diminution in size, and is transformed into a fibrous cord, through which the canal could not be followed. This constriction extends for 1·2 cm. and suddenly stops, the lumen of the vessel immediately beyond being larger than the proximal portion. Except for this area of constriction the vessel shows a less degree of sclerotic change than does the left coronary.

Microscopical examination of branches of the coronary arteries shows arterio-sclerotic areas, many of which are in the proliferative stage, while most show degenerative changes in the new tissue.

Microscopical examination of the affected area in wall of left ventricle shows a proliferative endo-myocarditis. Most of the inner layer of heart muscle has been replaced by dense fibrous tissue, and the opaque endocardial layer described is made up of this tissue with few islands of muscle substance. The muscle fibres show hyaline degeneration and many exhibit a separation of the primary fibrillæ. In the longitudinal sections segmentation of fibres, oftentimes with considerable displacement, is everywhere present. This change is more marked in the comparatively normal muscle fibres than in those imbedded in the inflammatory tissue.

Sections of ventricular wall from other areas, show a slight diffuse chronic myocarditis with muscular segmentation.

Aorta shows nodular arterio-sclerosis affecting principally the arch. Nodules are discreet and become fewer in number below the arch ; one focus at commencement of thoracic aorta is covered with a calcareous plate. Vessel has lost little of its elasticity, judged by gross tests.

Microscopical examination shows an arterio-sclerosis, which in most nodules is in the late stage of proliferation with hyaline degeneration of new tissue. Few patches show complete fatty metamorphosis beneath the endothelium.

Splenic artery is tortuous and generally thickened, with no prominent nodules. Endothelial coat granular.

Renal arteries show nodular thickenings, endothelium smooth.

Conclusions. We have to do with a generalised arteriosclerosis, affecting vessels of medium and small size particularly.

The localisation of the extreme process in a portion of the wall of left ventricle is undoubtedly dependent upon the obliteration of right coronary artery, the area affected representing the distribution of the terminal branches of that vessel.

The muscular segmentation, which was found generally throughout heart muscle, has rarely been described except in connection with acute diseases. It has always been a question whether the process was not a *post-mortem* change. In this case the autopsy was performed only twenty hours *post-mortem* and the tissues immediately placed in fixing fluids.

The absence of cardiac murmurs is remarkable, as judging from the *post-mortem* picture, it would have been impossible for the flaps of the mitral valve to meet, unless systole were accompanied by extreme distortion of the left ventricle. The absence of pain is also a remarkable feature.

DISCUSSION.

Dr. NEWTON: The case reported by Dr. Williams is exceeding interesting to a man doing clinical work, and his conclusions are very important. I saw a case a year ago last March, in which a number of good men were unable to make the diagnosis. The patient lived about six months after the onset of active symptoms, and Dr. Janeway was the only consultant who recognised the case as one of mycotic endocarditis. There was slight hypertrophy and at times a soft murmur could be made out. One of the best clinicians in New York pronounced the case one of latent tuberculosis. There was nearly entire absence of pain, but at times a fearful sense of impending doom. The man had always worked very hard, and at the time of his death was the President of a college. He had regular daily fever, thought by most of the medical men who saw him to be due to malaria. He had exhausting sweats and lost weight and strength rapidly. Dr. Ewing (New York) took some of the blood and thought that he found streptococci

in it. This conclusion Dr. Park did not coincide in. A number of other examinations of the blood, urine and bronchial secretions were negative. An autopsy could not be obtained.

Dr. N. S. Davis, Jun.: I cannot discuss this case particularly, as I have none in mind quite comparable to it. I might refer, however, to a case which I intend to report at some subsequent time, in which characteristic symptoms were slow to develop. The case was undoubtedly one of endocarditis, although at the beginning of the patient's illness there were no symptoms of endocardial trouble. The early symptoms were headache, very severe, with some nausea and vomiting, which led me to believe that the stomach was primarily at fault. In the course of three or four days he developed a fever which gradually increased, and at the end of two weeks a heart murmur was made out which was diastolic in character and heard most distinctly over the centre of the sternum. The fever persisted for three or four weeks; the patient became greatly emaciated and extremely feeble. During the sixth week of his stay in the hospital there occurred on several occasions some chills, sudden elevations of temperature to 104·5° and 105° F., followed by a sudden fall of temperature. The patient slowly recovered, to the surprise of all who saw him. The endocardial murmur gradually grew fainter, and when he left the hospital would be called a roughness rather than a murmur.

The above is simply an outline of a case which was carefully observed by me, and which I was led to believe was one of malignant endocarditis. There were no symptoms of any other infection. The Widal reaction was negative, as were also numerous blood examinations for the malarial plasmodium. The slowness of the onset of the symptoms, the persistence of the fever, the character of the temperature curve, all pointed to malignant endocarditis. This is the first recovery from this malady which I have seen.

Dr. Daland: I was very much interested in Dr. Williams' report of this case, which was carefully observed during life and followed by a pathologic study after death. Such a complete report of a case needs no apology. The absence of angina pectoris in this case is worthy of note, and we may be able, in the course of time, to learn more about the region of the heart affected when angina pectoris is present. The fact that the heart contracted feebly perhaps explains the absence of a murmur.

Dr. Brannan: I should like to say a few words regarding one factor, namely, the absence of a murmur in spite of a pronounced lesion of the mitral valve. I think as we gain in experience we meet with these cases with comparative frequency, and we are forced to believe that the existence or non-existence of a murmur often bears little relation to the anatomical conditions present. I had such a case last winter. The patient was a man who had rheumatism about two years ago, with a marked systolic murmur, which, in addition to other signs, suggested a lesion of the mitral valve, with incompetency. This murmur gradually disappeared and a pre-systolic murmur took its place. Last January he re-entered the hospital and there was no murmur present at all. He died suddenly without assignable cause, and the autopsy disclosed a mitral valve which was markedly contracted,

barely admitting one finger. At the time of his death there was no murmur, the heart was acting fairly regularly and with good force. For a week previous to his death he had received no medication.

The PRESIDENT (Dr. Jacobi): I showed a small specimen the day before yesterday, and referred briefly to the case of a child, aged 2, in which a systolic murmur had been present, first increasing, then decreasing, and finally disappearing. There was no doubt in my mind that it was a case of valvular endocarditis. The autopsy disclosed thickenings in the valves and localised small exudates; there was also a slight thickening of the edge of the valve. Still, no murmur could be heard, which simply proves that in some of these cases the murmur disappears. In children, particularly, the diagnosis is apt to be difficult, because the secondary dilatation and hypertrophy are not always visible. The younger the infant, the stronger and larger the heart relatively. In cases of undoubted endocarditis we may not find any dilatation or hypertrophy for long periods of time. In malignant endocarditis there may be deposits and still no murmur. I have seen, in a few instances, deposits in the insertion of the valves without murmur. Others have made similar observations. When, however, the deposits are at the edge of the valve, then we get a murmur.

I have recently had under observation a college boy aged 20, tall and very vigorous, who suffered from attacks of fever, with frequent chills and perspirations for a number of weeks, the temperature being irregular in character, with very steep curves. When I saw him he was quite exhausted. Malarial infection had been suspected, but it was known that he had contracted gonorrhœa when 10 years old. That never got well; gonococci were found from time to time. He evidently had a gonorrhœal arthritis and endocarditis, with a loud murmur and the irregular fever to which I have referred. In the course of many weeks he finally recovered from his arthritis and fever, but his murmur never disappeared. He still has his gonorrhœa.

Dr. NEWTON: I would like to add that in reference to the case which I have just mentioned, Dr. Janeway told me that of twelve similar cases which he had seen only one recovered, and in that case the endocarditis was of gonorrhœal origin.

Dr. SAMUEL A. FISK: The subject of endocarditis is of great interest to us in Colorado, because of the altitude, and the work that is thrown upon the heart in consequence. Furthermore, it is of great interest when it occurs in connection with pulmonary trouble. We are coming, I think, to the point where we lay less stress upon such cardiac conditions than we formerly did, because we know that those patients often get along very comfortably and sometimes get well. We have cases in Colorado where the disability has been known to exist for many years, and where the murmur has finally disappeared. I have in mind the case of a young boy, the son of one of our prominent physicians, who outgrew a heart murmur. I have also in mind a young man with a rheumatic tendency, who had a mitral lesion from which he recovered. Also another case, a child, where an endocardial murmur developed as the initial symptom of diphtheria, and

has since been outgrown. Such cases as these have led us to regard these cardiac lesions in a less unfavourable light than we formerly did, even in the high altitude of Colorado. We know that we can hold out some hope that these lesions may be outgrown. We see cases where they are outgrown. We see cases, more especially in adults, where hypertrophy has come in to relieve the engorgement and left the patient fairly comfortable.

The case of the child to which I referred, where the endocardial murmur was the initial symptom of diphtheria, is the only one of the kind I have ever seen. I would like to ask Dr. Jacobi if such cases are common?

Dr. JACOBI: I would say that in a good many cases it may be very difficult to differentiate between an endocardial and a myocardial murmur. The latter are very common in the infectious diseases and are apt to disappear after a time in many of the cases. I think this discussion should not be closed until we have heard from Dr. Babcock.

Dr. BABCOCK: I do not know that I can add anything to the discussion. It simply bears out the truth of the statement that we know very little about the causes of heart murmurs. Although a murmur is a very valuable guide-post, pointing out the direction in which we are to search, it is, as a matter of fact, of comparatively little importance in the actual diagnosis of cardiac valvular disease. We must rely upon the secondary physical signs largely in determining the actual nature of the lesion. It was once supposed that an aortic diastolic murmur was always present in aortic insufficiency, but we now know that it may be absent If one might theorise—which I dislike to do—it seems to me that the presence or absence of murmurs in any given case of valvular disease must depend largely upon the size of the orifice through which the blood passes. The condition which experimentally appears to favour the production of a murmur is a point of constriction, so that the blood stream, after passing that narrow point, enters a wider chamber, and in so doing is thrown into audible vibration. We have all seen cases in which, during life, there was no mitral systolic murmur, and after death the orifice has been found widely dilated, in consequence of dilatation of the ventricular cavity, the valves being healthy.

The case reported by Dr. Williams might, in a sense, be compared with those cases in which the leakage is due to stretching of the ring; the ring actually was stretched, while the valve flaps were only slightly thickened, the incompetency being really due to shortening of the cords and the consequent inability of the valves to adequately close the orifice.

This whole subject is still involved in obscurity, as are many points on the subject of heart disease.

Dr. WILLIAMS (closing the discussion): I am much obliged for the interesting discussion raised by my paper. No bacterial examination was made, because we wanted to study the subject of segmentation of the heart, which required hardening of the organ.

EXERCISES SUITABLE FOR CHILDREN SUFFERING FROM HEART DISEASE.

Dr. J. Madison Taylor presented a paper on "The Forms of Exercise suitable for Children suffering from Chronic Diseases of the Heart."

He began by alluding to the fact that a fair number of cases of heart disease are met with among people who have lived a long and arduous life, in whom this condition is recognised in very early years, and pronounced by competent clinicians to be most dangerous.

He had observed a number of instances in which at various ages an embargo had been laid by their medical advisers upon any form of exercise, and yet, upon a careful study of the conditions, the patients had been allowed increasing amounts of activity, and, usually, not only without harm but with actual benefit.

In carefully selected instances the use of regulated activities can be made to afford a large amount of relief to many of the distressing symptoms which accompany and follow disordered states of the heart; among these are passive engorgements of the vital organs, the disturbed anatomical relationships of the viscera, both thoracic and abdominal, due to faulty attitudes which so commonly follow upon chronic conditions, especially where those conditions are the result of enforced inactivities. If the bodily organs are not permitted or encouraged in the normal exercise of their functions, there is inevitably a certain amount of distress or discomfort both of the mind and body.

The term "exercise" should be kept clearly in mind to be

a normal use of the bodily parts, not only of the muscular system, as it is usually understood, but particularly the interrelation of the viscera and their mutual co-operation.

The first and most important item is that the individual should learn to sit, stand, and move in proper attitudes, for only thus can this symmetrical activity of their various parts be maintained. An invaluable form of exercise is the act of breathing correctly enforced and practised. Much good can be accomplished by this alone, in maintaining not only the integrity of the blood, but the voluntary and semi-voluntary structures surrounding and controlling the vital organs. Some clearly defined rules are then given how this should be done, beginning in a passive attitude, lying on the back, &c., and gradually increasing the breathing exercises, and supplementing them by gentle passive movements inducing flexibility of the limbs, and gradually working up to such voluntary activities as are permissible in each particular case.

After outlining this matter somewhat more fully, Dr. Taylor related his experience in adapting these to children, showing what remarkable results are sometimes brought about by movements which would seem to be of the simplest sort. He enumerated the benefits which result from the readjustments of the muscles of the trunk and limbs, also stretching, both active and passive, with the cautious use of both massage and baths. Most of the movements should begin in the recumbent posture, and all are followed by long periods of rest, lying down. Certain rules of procedure can be formulated after a careful estimate is made of the condition of the heart and other organs; but the most useful rules are those resulting from a watchful experience. Thus it is often found that more rapid progress can be made than by the most carefully outlined predictions. It is never possible to estimate the factors which enter into any one case even by the most skilful; and therefore the measures must be cautiously tried, and increased with careful judgment on the effects obtained.

Thus many distressing symptoms are often relieved, and certainly great comfort and pleasure in living afforded, and, finally, greater activities may be permitted than had been usually thought possible, both as to physical health and mental serenity.

DISCUSSION.

Dr. JACOBI: In cases of heart disease of the acute and sub-acute types, and very often in chronic cases, I know of nothing better than absolute rest. Many of the latter class of cases are overworked. Put such patients to bed and they will recover from their dyspnœa and ascites and other secondary symptoms, but they must remain in bed long enough. Acute cases will get well with rest only.

As far as passive movements and massage are concerned, I entirely agree with what the Doctor has said, because it is impossible to relieve the heart when there is no peripheral circulation. The latter can be established only by some form of exercise. We should not overlook the skin. The skin contains a large part of our blood all the time. There are 14, 15 or 16 square feet of surface to every adult, and the skin covering that surface contains an immense quantity of blood. If there is no circulation in the skin, the heart will suffer. That is why applications of water, either warm or cold, or alcohol and water, and friction and massage do so much good. They relieve the heart and give it an opportunity to contract again. Under rest treatment I have seen largely dilated and hypertrophied hearts get smaller until they almost reached their normal size. Murmurs, when they are valvular, will mostly not disappear entirely, but murmurs are frequently partly valvular and partly myocardial, and by rest the latter may disappear as the condition of the myocardium improves. I have frequently seen such cases improve by rest in bed, applications of cold water to the skin, friction, massage, and sometimes cupping and the administration of strychnia. The massage should either be done by the physician himself, or by one who knows some anatomy, in preference to those people, male and female, who practice what they call massage in order to be paid as much for one hour's work as a nurse earns in a day. To do massaging intelligently, one should know where the muscles, blood-vessels and lymph-ducts run, so that the finger can be used where unskilled people use their entire hand indiscriminately. I believe in rest in heart disease, at the same time stimulating the action of the skin. Passive motion is also valuable. Most of the peripheral circulation is controlled by the striped muscles, and unless they are exercised there can be no peripheral circulation, and if there is no circulation in the outlying parts there can be no proper cardiac circulation.

ANEURISM OF THE HEART, WITH THROMBOSIS OF THE LEFT CORONARY ARTERY.

BY JUDSON DALAND, M.D.

PHILADELPHIA.

THE occurrence of cardiac aneurism as a late manifestation of syphilis is so unusual and interesting that I venture to report this case, which occurred in the practice of my friend, Dr. Isaac Leopold, to whom I am indebted for the following clinical notes :—

The patient was a married man, aged 54, and presented nothing of importance in his family nor early personal history. Twenty-seven years before death he contracted syphilis and one of his children now shows signs of having inherited this disease. Two years before his death an ulcer appeared upon the side of the tongue, extending from the tip to the base, which yielded to specific treatment. He was a chronic alcoholic for thirty years, but most of the time to only a moderate extent. The family state that four years before his death he nearly died of "heart trouble." One year later he suffered from leukoderma of the hands, wrists, neck, face and chest, and the following year he was examined for life insurance and considered a good risk. Five years before his death he complained of occasional attacks of epigastric pain and a sense of fulness after eating. He also complained of moderate deafness due to thickening of the membrana tympani and calcareous deposits, especially in the drum of the right ear. The naso-pharyngeal mucous membrane showed atrophic changes. Later the leukodermic areas became darker in colour.

He retired on Tuesday evening in his usual good health and spirits, but complained of wakefulness and restlessness during the night. At 6.30 the following morning, he was unconscious, the lips, face and finger tips cyanotic, and the feet, face and surface of the body cold. There was no radial pulse, and the heart sounds were indistinguishable. Respirations were shallow, regular and numbered twenty-five to the minute. The pupils were contracted and gave no response to light. A few moments later he arose to a sitting position and endeavoured to leave the bed, stating that he desired to use the commode. After voiding a large stool he again became unconscious, with complete muscular relaxation and the attending physician thought he was dead. The free use of strychnine and brandy, hypodermatically, and strong counter-irritation over the præcordia, was followed by partial reaction. Vomiting then occurred and each act of emesis was followed by syncope. Again recourse was had to the hypodermatic use of brandy, strychnine, aromatic spirits of ammonium, and a rectal injection of hot water ; and the pulse, which had disappeared, could now be felt at the wrist. The pulse beat from twenty-five to thirty per minute, between 7 and 8.15 a.m., but no cardiac sounds were distinctly audible. The respiratory sounds were clear in the anterior portion of the chest, but over the bases there were moist râles. Nitroglycerine, in doses of $\frac{1}{50}$th of a grain, aroused the patient on one or two occasions, and appeared to lessen the lividity of the extremities. The skin was not clammy, but the entire exterior of the body was cold from the beginning of the attack until death.

Two hours after the onset of this attack his family physician arrived, at which time the patient was able to converse, and stated that he felt very badly but had no pain, excepting that produced by slight burns from a hot water bottle used as a counter-irritant in attempting to arouse him from his syncopal attacks.

Every fifteen or twenty minutes there was an unsuccessful attempt to urinate, and by the introduction of a catheter, $\frac{1}{2}$ an ounce of clear, pale urine containing no albumin nor sugar, was secured. After an injection of nitro-glycerine, $\frac{1}{100}$, and strychnine $\frac{1}{30}$, the pulse fell from forty to thirty and the cyanosis disappeared, but returned upon the slightest exertion. He was catheterized at 7 and 11 p.m., but no urine was obtained. Vomiting persisted at varying intervals during the entire day, and was chiefly composed of yellow mucus, which upon one occasion was slightly blood-stained. There was considerable thirst, and as water seemed to excite vomiting, ice was given.

Sixteen hours after the beginning of the attack the patient was resting fairly well but the face and finger tips were still cyanotic, the extremities cold, the pulse beating at the rate of fifty-five per minute, and at times disappearing. The mind was clear, the pupils small, and there was a constant disposition to vomit and frequent unsuccessful attempts to urinate. Three hours later the patient's distress increased, the radial pulse disappeared, the extremities were cold, cyanosis deepened, and respirations averaged forty-five to fifty per minute. While discharging into a bed-pan three tablespoonfuls of dark, bad-smelling blood, he suddenly expired.

The autopsy was performed at midnight, twenty hours after death, with the assistance of Dr. Isaac Leopold. The body was of moderate size and weighed about 148 pounds. The ascending vena cava was over-filled with dark venous blood. The thoracic aorta showed advanced deforming endarteritis and a few calcareous plates. The orifice of the right coronary artery was almost occluded by a deposit of lime salts, and was only sufficiently large to permit the passage of a very small probe, of the thickness of a hair pin. The wall of this artery throughout its entire length was greatly thickened and in places the vessel is twisted upon its own axis (see fig 1). About 2 inches from its origin there is a localized irregularly shaped mass of

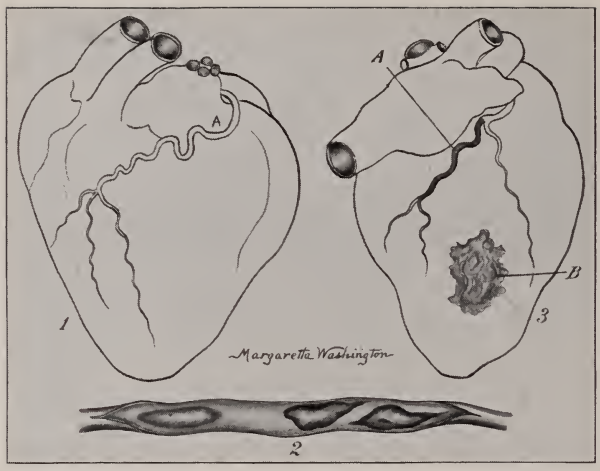

FIG. 1.—Extreme tortuosity of the right coronary artery.
FIG. 2.—The right coronary artery laid open so as to make visible the masses of fibroid material in the wall, which projected into the lumen of the vessel to such an extent as to cause almost complete occlusion. When the artery was emptied of blood a very fine probe could be passed through it by lifting the thinner portion of the wall away from these masses.
FIG. 3.—(*A*) A moderately tortuous left coronary artery, the shaded portion of which represents the regions filled by a thrombus; (*B*) shows the location of an area of chronic pericarditis, immediately overlying the aneurysm of the heart.

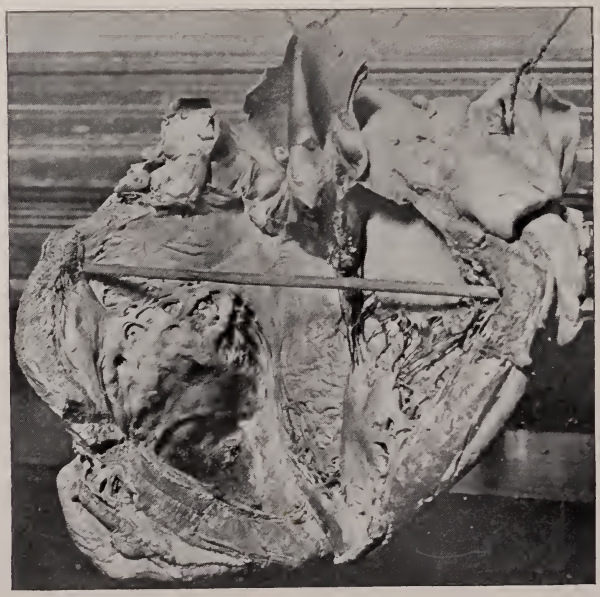

FIG. 4.—The left ventricular cavity; the darker portion shows the aneurysm and dilation of the apex, covered with a thrombus.

soft atheroma, about $\frac{1}{4}$ of an inch in length, and immediately below this is another somewhat similar in size, shape and appearance. These masses almost occlude the lumen of the vessel. With the greatest difficulty a very small probe could be passed through this portion of the artery by lifting away the anterior wall of the blood vessel (see fig. 2). During life the stream of blood flowing through the artery must have been very small. The left coronary artery was patulous, of a normal calibre, and the walls show well-marked fibrosis. Below the point, where the left coronary artery gives off the left inter ventricular branch, the vessel is entirely occluded by a thrombus, which extends for a distance of 1 inch (see fig. 3 *a*.)

The left auricle was moderately dilated, its muscular walls slightly thickened, and here and there were localized areas of fatty degeneration.

The left ventricular cavity was moderately dilated and the walls hypertrophied, measuring fully 1 inch to $1\frac{1}{4}$ inches in thickness. The muscular fibre was of fair consistency, and there was evidently considerable fatty degeneration. The columnæ carnæ and papillary muscles showed hypertrophy. On the inter ventricular wall of the left ventricular cavity there was a large white fibroid patch, measuring 2 by $2\frac{1}{2}$ inches, irregularly rounded in shape. Most of the inter ventricular septum is included in this region of fibroid degeneration. The septum was reduced to $\frac{1}{3}$ of an inch in thickness. This sclerosis extends through to the right ventricle, where it is visible as an irregular fibroid area, measuring 1 inch by $\frac{3}{4}$ of an inch, with the long diameter corresponding to the long axis of the heart and extending well down to the extreme apex of the right ventricle. One of the fleshy columns passing from this patch to the opposite wall had also undergone the same change. The fibroid degeneration of the inter ventricular septum and wall of the left ventricle had permitted a sacculated dilatation of two-thirds of the septal side of the left

ventricular cavity to take place, into which could be placed a large English walnut (see fig. 4). The pericardium at the base of this sacculation was firmly attached to the parietal pericardium by an old firm adhesion, covering an area about the size of a silver half dollar (see fig. 3B). At the extreme tip of the left ventricular cavity, corresponding to the left apex, there was an area of ulceration which had involved the endocardium and myocardium, having a diameter of about ½ an inch, to which was attached a fresh thrombus, and when this was removed an old thrombus, partially decolorized, was revealed (see fig. 4). The base of this region was composed of a thick fibrous tissue, over which is spread a thin layer of fat, and constitutes anatomically the extreme tip of the apex.

The aortic valves were normal and competent, as shown by the water test. With the exception of a small yellow patch of soft atheroma at the base of the anterior leaflet of the mitral valve, these valves and orifice were normal. The right auricular and tricuspid valves and orifice were normal, as was also the right ventricular cavity, with the exception of the sclerotic area already described.

The lungs showed marked œdema, but were otherwise normal. The kidneys, with the exception of congestion, showed no pathologic change. The liver was slightly enlarged and its consistency was increased. The under surface of the left lobe showed a small scar. The gall-bladder contained a small quantity of bile, black in colour, and also a small quantity of mucus, in which was found six small gall stones, faceted and presenting a mulberry appearance. The spleen was three times its normal size, but otherwise normal. The omentum is loaded with fat. The stomach, duodenum and jejunum were normal, but in the region of ileum the mucous membrane shows acute inflammatory changes.

The brain, so far as size, shape, and the appearance of the convolutions were concerned, seemed normal. The pia mater, covering the cerebrum, was opaque and thickened. There

was a moderate serous exudate, and the arteries forming the circle of Willis showed numerous small white patches of atheroma. Further examination of the brain was negative and no cerebral or meningeal hæmorrhage was present.

A study of recorded cases shows that fully 60 per cent. of all left ventricular aneurisms occur in the region already described.

Examination of the 81 cases reported by Legge,[1] shows that the greatest number occurred between the ages of 51 and 60, in which class this case would fall.

In 85 of the 87 cases reported by Pelvet,[2] the apex was the seat of the aneurism.

Fifty-nine of the 74 cases of cardiac aneurism reported by John Thurnam,[3] affected the left ventricle, of which 9 were the size of a nut, 20 the size of an English walnut, 7 the size of a fowl's egg, 14 the size of an orange, and 9 the size of the heart. Here again this case agrees with the rule that the majority of aneurisms of this region are the size of a walnut. In 25 of these 74 cases the wall of the aneurism was composed of the endocardium and pericardium, which was true in this case; and in 21 cases pericardial adhesions were observed. In the 24 cases in which the mode of death was stated, none were reported as having been caused by a thrombus.

Certain of the cases reported by Dr. Whipham[4] resemble the one here described, in the total absence of previous cardiac symptoms and in the occurrence of sudden death.

Rokitansky[5] reports 6 cases of aneurism of the left ventricular cavity, 3 occurring in men and 3 in women between the ages of 70 and 74, and in 2 cases, the aneurism encroached upon the right ventricular cavity.

[1] J. Wickham Legge, "Bradshaw Lectures on Cardiac Aneurisms," London, 1884.

[2] Pelvet, "*Des Anéurysmes du Cœur*," Paris, 1867.

[3] John Thurnam, "On Aneurisms of the Heart, with Cases," *Medico-Chirurgical Transactions*, vol. xxi., p. 218.

[4] Whipham, *London Pathological Transactions*, vol. xxi., 1870.

[5] Rokitansky, "*Die Defecte der Scheidewande Des Herzens*," *Wien*, 1875

Most authors are agreed that aneurism of the heart is more frequent in the male than in the female, and that rupture is not uncommon.

Dr. Wills[6] reports a case of cardiac aneurism the size of a pigeon's egg, the walls of which were calcareous and the cavity completely consolidated.

Dr. Ludwig Hektoen[7] reports a case of sudden death due to embolism of the left coronary artery.

Dr. J. G. Taylor[8] reports a case of sudden death, occurring in a woman aged 25, due to obliteration of the right coronary artery.

That syphilis existed twenty-seven years before death is clearly shown by the history of this case, and that the syphilitic virus continued to exert its effects up until a few years before his death, is also proved from the appearance of hereditary syphilis in one of his children. The occurrence of a lingual ulcer two years before his death, which promptly yielded to specific treatment, also corroborates this view. It is more than probable that the chief cause of the widespread disease of the arteries was this same poison, but it must not be forgotten that chronic alcoholism also acted as a contributory ætiological factor. It is quite likely that the cardio-vascular changes began years before his death and were slowly progressive. The almost complete substitution of fibroid for muscular tissue in the inter ventricular septum began months or years before the symptoms of his last illness.

The extreme obstruction of the right coronary artery, not only near its orifice, which was narrowed to the size of a hair-pin, and the localized thickening of the wall of this vessel, must have required months or years, during which time there was a progressively increasing interference with the

[6] Dr. Wills, *London Pathological Transactions*, vol. viii., 1878.

[7] Dr. Ludwig Hektoen, *Medical News*, August 20, 1892.

[8] Dr. J. G. Taylor, *Proceedings of the Pathological Society of Philadelphia*. May 12, 1898.

supply of blood to that portion of the heart supplied by this artery, constituting a reasonable explanation of the development of fibroid changes in the septum and later of the occurrence of the aneurism. It is particularly interesting to note the method by which Nature attempted to strengthen the weakest portion of the wall of the left ventricular cavity, above the apex, by the formation of an organized clot on the ventricular side and of chronic localized pericarditis upon the pericardial side of the heart. Despite similar changes in the left coronary artery, no symptoms were complained of by the patient, with the exception of an indistinct history of heart trouble, four years before death, and no abnormality was detected three years before death, at which time he was examined for life insurance. It is also true that the heart was able to meet all the ordinary demands of life, and it seems clear that the occurrence of sudden death, in twenty hours after the first symptoms of cardiac failure, is best explained by the slow formation of a thrombus in the left coronary artery, which finally completely shut off the blood current from the region supplied by this vessel. In view of the widespread changes in both coronary arteries and the extensive secondary changes in the myocardium, it is interesting to observe the complete absence of cardiac pain or angina pectoris. This case clearly shows that widespread and advanced myocardial and coronary changes may take place without producing a single cardiac symptom, and it also shows how easily these changes are overlooked when the heart is examined, as is demonstrated by the fact that three years before his death he was considered a good risk by a life insurance examiner. This case also demonstrates the necessity of thorough, complete and long-continued specific treatment in every case of syphilis.

DISCUSSION.

Dr. CURTIN: I have seen three cases of aneurism of the heart during life, and they all died slowly. I have never seen a case of sudden death from aneurism of the heart, although in one of my cases after death, the aneurism was found to contain a cavity large enough to hold a pint of water. In that case the man lived for three years, in spite of the enormous dilatation of the walls of the left ventricle. On one occasion, an aspirating needle was inserted into the sac and eight ounces of blood withdrawn; this was fully six months or a year previous to his death.

Probably, in Dr. Daland's case, there was some sudden interference with the circulation of the heart itself.

Dr. JAMES B. WALKER (Philadelphia): I have reported a case of aneurism of the inter-ventricular septum, extending from the left to the right ventricle. Perforation occurred at the centre of the enlargement, which was about the size of a shilling; it was not a recent rupture.

Dr. J. MADISON TAYLOR: I recently saw a case of aneurism with a very large sac, probably 1¾ inches wide and 1½ inches vertically. There was a sacculation of the aorta which was treated by the insertion of gold wire and electricity. The patient lived for two or three years after the onset of his symptoms, and finally died of exhaustion.

Dr. BABCOCK: If I understood Dr. Daland correctly, the inter-ventricular septum was largely fibroid in character, excepting in its upper part. Sudden death is very common in cases where fibrous degeneration affects the inter-ventricular septum.

Dr. THOMAS C. COLEMAN: These cases of aneurism of the heart with subsequent rupture, are interesting, in that they may give us a scientific explanation of an historic event that interests all mankind, and also as to whether one can die of a "broken heart," or more technically, whether rupture of the heart can result from deep emotion. The subject brings to mind a paper which I read a number of years ago. It was from the pen of Sir Spencer Wells, I think, and in it he was in an altogether reverential way endeavouring to account for the physical facts of the Saviour's death on the cross. In the account, as given in the Bible, it is stated that, when the soldier plunged, the spear into the side of the Saviour, bloody water came out. The author of the paper mentioned endeavours to show that for this to have been the case, there must have been rupture of the heart, escape of blood into the pericardial sac, and the consequent formation of a clot with serum around it. In the further progress of the paper, he mentioned several cases of rupture of the heart that he had encountered at the autopsy table.

Dr. DALAND: In the account of the crucifixion to which Dr. Coleman referred, we are not told which side of the body was pierced; it is entirely a matter of speculation whether it was the left side or the right. The term "broken heart" usually pre-supposes a myocardial change.

I have heard of the case to which Dr. Curtin referred, in which the

aneurism of the heart was so large that the question of pleurisy with effusion was raised. A needle was introduced with the idea of removing this effusion, and instead of serum, a large amount of blood was withdrawn, which seemed to benefit the patient. This case is certainly unique.

My case can scarcely be regarded as one in which sudden death was caused by the cardiac aneurism. The immediate cause of death, I believe, was due to the formation of a thrombus in the left coronary artery. With cardiac aneurism death frequently occurs slowly, although a number of cases of rupture causing sudden death are reported.

THE INADEQUACY OF THE PHYSICAL SIGNS AS INDICATING THE GRAVITY OF A PNEUMONIA.

BY ANDREW H. SMITH, M.D.

NEW YORK.

In a disease having such distinctive physical signs as we encounter in a typical case of pneumonia it is natural to rely in great measure upon these signs in forming our estimate of the gravity of a particular case. Or rather, I should say, we are prone to accept the extent of the consolidation as indicated by the physical signs as an index of the severity of the attack. The area of percussion dulness and of bronchial breathing, unconsciously to ourselves perhaps, is in a great degree the measure of the peril to which we feel that our patient is exposed. We watch the increase of this area with grave anxiety, and note its diminution with intense satisfaction. And in general we are right enough in this. *Other things being equal*, the danger is pretty fairly apportioned to the amount of lung involved.

The actual degree of this involvement, however, is not always easily determined. It happens to all of us with more frequency than is quite comfortable that an autopsy brings unexpected revelations as to the condition of the lungs. In many persons the respiratory murmur in health is very feeble, sometimes almost inaudible even with forced respiration. In such persons the initial crepitus of pneumonia may easily escape detection, and the later bronchial breathing is not well pronounced. This is especially true when there is a thick layer of adipose tissue overlying the chest. In the latter case

the percussion dulness also is obscured. But even under the most favourable circumstances, and with the best trained ear, it must be admitted that the resources of auscultation and percussion scarcely supply the data for a fine and accurate appreciation of what is going on in the lungs. The methods at best are but clumsy ones. The affected area may be at a distance from the surface of the lung and separated from it by a considerable thickness of tissue yielding sounds of varying significance.

The resiliency of the chest wall is a variable factor at different ages and under different conditions. The presence of pulmonary emphysema or of old pleuritic adhesions may complicate the results of auscultation and percussion.

Add to this the restriction which the comfort and perhaps the safety of the patient may impose upon a careful and thorough physical examination, and it will readily be seen that, valuable as the physical undoubtedly are, they are by themselves quite inadequate to a full exposition of the changes taking place in the lung.

But aside from the difficulties just mentioned there are points regarding the physical signs which I believe to be very important. If we could in every case determine the limits within which consolidation had taken place we should still be uncertain as to the full import of the condition present. For the area of consolidation may and often does fall far short of the area in which toxin is being formed. So long as the disease is advancing in the lung there will always be a zone outside of the consolidated area in which the amount of exudate in the air-cells will not be sufficient to cause notable signs, but in which, nevertheless, an active formation of toxin is progressing. The slightest film of fibrin upon the wall of the vesicle will harbour a colony of pneumococci whose toxin will be under the very best possible conditions for absorption. Unlike the fully filled alveoli, these will have an active circulation going on in their functional capillaries, and the toxin as it is formed

will be immediately taken into the circulation. Nor is this all. The younger the organisms the more virulent is the poison formed by them ; so that, while cultures taken from the centre of a consolidated area show little toxicity, cultures from the circumference of such a patch present the maximum of virulence.

Now as the toxemia in pneumonia plays quite as important a part as the restriction of the breathing surface, it is clear that, so long, at least, as the local process is spreading, there may be serious mischief going on which will give very little if any indication of its presence through the medium of the physical signs. Ausculation over this advancing zone will afford only occasional moist râles which would scarcely attract attention. More significant might be, perhaps, a diminution or suppression of the vesicular murmur, a sign not much dwelt upon, but which sometimes precedes the crepitant râles. Percussion would be of little avail, as the dulness would shade off imperceptibly from the hepatised area. But whatever may be the actual condition of the lung itself, the question as to the gravity of a pneumonia includes many other factors. The most important of these is the soundness of the patient before the attack. Pre-existing morbid conditions probably determine the outcome of a very large proportion of fatal cases. Thus of seven cases occurring in subjects of chronic kidney disease, in the Presbyterian Hospital, only one recovered. Of eleven cases with pre-existing valvular hyperplasia eight proved fatal. Five patients with cirrhosis of the liver all died. Four cases in phthisical subjects were all fatal. In these examples the result evidently depended in large measure upon conditions that bore no relation to the physical signs of the pneumonia.

The lesson we are to learn from this, it appears to me, is that, while the physical signs in pneumonia are very valuable in establishing the diagnosis, they cannot be relied upon altogether to indicate how sick the patient really is. On this point the information to be derived from the rational symp-

toms is quite as important. This is especially true in the earliest stage. Even before the chill, or before there is any considerable rise of temperature, there is in 25 to 30 per cent. of the cases a prodromic stage marked by *malaise*, headache, anorexia, dull pains in limbs and back, and perhaps epistaxis and diarrhœa. This stage may last for two or three days or more, during which time there will be absolutely no change discernible by ausculation or percussion. The only thing to point to the lungs may be a slightly increased ratio of the respiration to the pulse. If we see the patient during this stage, which we seldom do, abortive treatment may be eminently successful. But if we wait until the physical signs make the diagnosis absolutely certain the golden opportunity may be lost. And here I would emphasise the unwisdom of repeated and exhausting physical examinations after once the diagnosis is established. The progress of the disease from that time on can readily be followed by the symptoms with very little aid from the signs, and thereby much distress and it may be no little danger can be saved to the patient. Especially should the consultant, if called by a competent practitioner, forego the temptation to a display of thoroughness, and, accepting for the most part the statement given to him of the physical signs, base his advice upon the symptoms and the general aspect of the case.

What needs mostly to be looked for is the occurrence of pulmonary œdema or of pleural or pericardial effusion, and having these possibilities always in mind we do not need a frequent resort to physical examinations to assure ourselves in regard to their presence or absence.

As to the consultant, by the time his services are required the important question will be, not how much or how little pneumonia is present, but how the patient is bearing it, and this will be answered more by the symptoms than the signs.

THE BLOOD CHANGES IN HIGH ALTITUDES.

BY S. EDWIN SOLLY, M.D., M.R.C.S.

COLORADO SPRINGS.

I DESIRE to give a brief synopsis of the blood investigations carried on under my direction in Colorado during the past year. The conclusions to be drawn from them confirm, in a general way, the observations made at similar altitudes; but the absolute proof that the total increase of red cells and hæmoglobin is real and not merely apparent, has not yet been obtained. However, I believe some further advance has been made in unravelling the tangled skein of causes and effects which combine to produce and modify these well known phenomena.

Dr. Judson Daland and I made some blood experiments upon the top of Pike's Peak, which showed great excess of red cells and hæmoglobin in two healthy men who had resided on the Peak for three months; also an increase in our own blood after ascending from Colorado Springs and a dropping back after our return. These matters Dr. Daland will, I trust, himself give you in detail. Perhaps the most valuable work done during the year was the examination of the blood of twenty-five healthy male students of the college in Colorado Springs. The blood was examined several times at the same time of day and the results averaged. The total averages were as follows:—

Place of observation, Colorado Springs; altitude, 6,000 ft.; time, 11-12 m., July, 1900; number of students, twenty-five; age, 22 years; duration of residence, eight years; number

of red cells, 5,927·00; hæmoglobin, per cent. 101·7. The eldest student was 28 years and the youngest 17 years. The shortest period of residence was seven months, the longest twenty-three years. While all the students were apparently in good health, yet several were doing too much—taking care of furnaces, lawns, &c., as well as attending college, and a few were over-working in athletics. In future enquiries the matter of exercise and social conditions must be more considered.

The length of residence appears to have a decided influence upon the degree of blood change. In four natives, and three who came to Colorado when under 7 years of age, the combined average number of red cells was 5,724·55 and the per cent. of hæmoglobin was 101·7, whereas in sixteen students who had resided in Colorado not more than three years nor less than seven months the averages were higher, 6,701·17 red cells and hæmoglobin, per cent. 102. This rather indicates that though the red cells and hæmoglobin averages higher among the natives of altitudes than those of low level climates, yet a too prolonged residence without change to sea level is not as beneficial as a shorter period of residence. In two students who had resided twelve years and eight years respectively, the red cells averaged 6,385·00.

DISCUSSION.

Dr. BALDWIN: I cannot let this opportunity pass without asking Dr. Solly if he is acquainted with Dr Bergtold, of Denver, and his contribution on the condition of the blood of persons upon their arrival in Colorado, and again some months later as to the hæmoglobin changes determined by the specific gravity method. It has seemed to me a valuable contribution and carefully performed work.

Dr. SOLLY: I have seen Dr. Bergtold's article, and know of the good work he has done in this line.

Dr. NEWTON: I was very much impressed with the fact that the gentleman from Philadelphia did not react as quickly as the gentleman from Colorado. Whether that fact was due to his residence or not I do not know.

I would like to inquire if there are any publications on the subject of the effect of tuberculin injections upon the blood? Whether they produce an increased leucocytosis or not? And if so, whether this is in proportion to the amount injected or the condition of the patient. It seems to me that this has a very important bearing upon the subject.

Dr. BABCOCK: I hope the Doctor does not mean to imply that our Philadelphia friends are slow. I have not found them so.

Dr. OTIS: I have always been a doubting Thomas regarding the occurrence of an absolute increase in the blood cells in going from the sea level to high altitudes. I trust Dr. Solly will enlarge upon his experiments in this connection, for it seems to me that we need a large number of observations upon this subject before it can be definitely settled in all its aspects.

Dr. MINOR: I would like to ask whether the blood which is obtained from the peripheral vessels is always a good index to the character of the blood throughout the body?

The skin being the first organ to feel changes of barometric pressure should show in the blood circulating in it a very different corpuscular condition from the blood of deep-seated organs, and cannot, it seems to me, be taken as a fair test of the average composition of the blood.

Dr. DALAND: There is no question but that the count of the blood differs, depending upon the part of the body from which it is taken, and whether it is taken from an artery or a vein. The variability of the capillary blood is dependent on a number of conditions: it is modified, for example, by massage or excitation of the skin. We must abide, however, by the results obtained from examining the capillary blood periphery, because for practical purposes we cannot take it from the deeper vessels.

I was very much interested in Dr. Solly's observations upon the blood changes in the twenty-five students who reside in high altitudes. I also have examined the blood of a similar number of students living in Prague, Bohemia, and the maximum number of red cells found was 6,500,000; the minimum number was 4,500,000 and the average 5,025,000. The average number of all my observations of this kind was 5,200,000, which comes within the general normal average.

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